Wm. Wavells

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AN ESSAY ON THE RECOVERY OF THE APPARENTLY DEAD.

BY CHARLES KITE,

—K

Member of the Corporation of Surgeons in London,
and Surgeon at Graveſend in Kent.

Being the Eſſay to which the Humane Society's Medal was adjudged.

To which is prefixed,

DR. LETTSOM's ADDRESS
ON THE DELIVERY OF THE MEDAL.

——— *hac animas ille evocat Orco*
Pallentes. VIRG.

LONDON:
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BRITISH MUSEUM

DR. LETTSOM having been appointed by the members of the Medical Society of London, to deliver before them, and the Preſident, Vice Preſidents, Clergy, and Governors of the Humane Society, the honorary medals of this inſtitution for the year 1788, the following extracts from his addreſs on the occaſion are prefixed, in order to explain the proceedings of theſe Societies.

"I CANNOT, Gentlemen, better "explain the occaſion of the preſent "meeting, than by introducing the "proceedings of the Humane and "Medical Societies; which I ſhall "requeſt to do by their reſpective "minutes."

£1 ¥

‘ MEDICAL SOCIETY of LONDON,
‘ July 30th 1787.

‘ The following reſolution of the ‘ Humane Society was laid before the ‘ Medical Society, by the Preſident, and ‘ read.

“ HUMANE SOCIETY,
“ July 19th 1787.

“ JOHN DAVENPORT, Eſq; in the chair,

“ *Reſolved unanimouſly,*

“ That the Medical Society of “ London be reſpectfully requeſted to “ be the adjudicators of the firſt prize “ medals for the beſt original Eſſays on “ SUSPENDED ANIMATION, which are “ to be adjudged the ſecond week in “ March 1788; and that the Regiſter “ tranſmit this unanimous reſolution to “ the Medical Society, and report their

" anſwer to the next meeting of the
" Humane Society.

" Signed, by order,
" WM HAWES, Regiſter."

'The Society having taken this 'propoſal of the Humane Society into 'conſideration, the ſame was agreed to 'unanimouſly; and the Secretary was 'ordered to notify to the Regiſter of the 'Humane Society, that the requeſt of the 'latter was complied with: The Secretary 'therefore drew up an anſwer, in the 'form of a reſolution, as follows.

'Monday, July 30th 1787.

'At a meeting of the *Medical Society* '*of London*, held this evening,

'DOCTOR JAMES SIMS, Preſident, in
'the chair;

'THIS SOCIETY having taken into 'conſideration the reſolution of the

'Humane Society, of the 19th of July, 'relative to the adjudication of the firſt 'prize medals for the beſt original Eſſays 'on Suſpended Animation, it was 'unanimouſly reſolved, that thanks be 'returned to the Humane Society for 'the honour propoſed, and that the polite 'offer of that Society be cheerfully 'accepted.

'Signed, by order,
'W^M^ CHAMBERLAINE,
'Secretary.'

'AT A MEETING of the 'MEDICAL SOCIETY of LONDON, held 'at their houſe in Bolt Court, Fleet Street, 'on the 26th day of March 1788;

'Mr. SOLOMON WADD, Chairman of 'the Council, in the chair;

'THE SOCIETY having read, and 'deliberately conſidered, *Eight Diſſertations* 'on the Prize Queſtion propoſed by 'the Humane Society, and ſubmitted to 'their determination, do adjudge the

'GOLD MEDAL to the Author of the
'Diſſertation, whoſe motto is,

'*Arteria animam accipit è pulmonibus.*

'And the SILVER MEDAL to the Author
'of the Diſſertation, diſtinguiſhed by the
'motto,

'——— *hac animas ille evocat Orco*
'*Pallentes.*'

'THE SOCIETY expreſs, at the ſame time, their cordial approbation of the liberal conduct of the Humane Society, for this ſignal inſtance of their zeal for promoting the intereſts of humanity, and of ſcience in general.

'Signed, by order,
'W^M CHAMBERLAINE, } Secretaries.'
'JAMES HILL HOOPER, }

◆

" THE reſpectful ſenſe I entertain " of this Diſſertation *; and of its " immenſe importance in the pathology " of diſeaſes, were the experiments it " contains uniformly confirmed, induces " me to hope, that other ingenious men " may explore the ſame track, and with " equal candour, enlighten ſcience. Some " celebrated anatomiſts, we know, have " drawn different concluſions from ſimilar " phœnomena. The modern HUNTER, " from ſome experiments, reſembling " thoſe of our Author, deduces likewiſe " different concluſions ; particularly " reſpecting *the colour of the blood*, and the " *irritability of the heart*. From colliſion, " light is produced, and truth becomes

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* This refers to the Diſſertation with the motto,

" *Arteria animam accipit è pulmonibus* ;"

an epitome of which Dr. Lettſom introduced into the Addreſs: but it is here omitted, as well as the Obſervations on the Circulation of the Blood, the Properties of different Kinds of Air, and the Phyſiology of the Lungs.

" clearer by inveſtigation. May the " learned Author, who has given ſuch " an originality and brilliancy to the " ſubject wiſely propoſed by the " HUMANE SOCIETY, perſevere, with " an ardour equal to the importance of " the prize, under a ſentiment delivered " by Seneca—*Rerum natura, ſacra ſua* " *non ſimul tradit.*

" I cannot, Gentlemen, forget to " mention the methodical and ingenious " Eſſay, to which the SILVER MEDAL has " been adjudged *; which contains not " only many experiments illuſtrative of " the cauſe of death, but alſo a minute " and uſeful detail of the means of " reſuſcitation; to which are added, " tables, conſtructed in a manner equally " ingenious and uſeful, which ſhew, in " a glance of the eye, the proportions " of premature deaths, and of ſucceſsful " recoveries, with the particular ſtates of " the body, the ſymptoms of life and death,

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* Mr. KITE, the Author of the preſent Diſſertation.

" and the means employed, whether " ſucceſsful or the contrary. Theſe " tables muſt be highly important in " future diſquiſitions of this kind, with " which, I truſt, the public will often " be favoured, as long as ſcience is founded " upon, and illuſtrated by, experiment; " which, in the medical art, is the " fountain of truth.

" The Author has paid ſingular " attention to the powers of the " ELECTRICAL FIRE; this active fluid, " which pervades earth and air, is in the " former, the tremendous agent of " earthquakes; and in the latter, of " thunder and lightning; equally terrible " to man; till FRANKLIN, from the " new hemiſphere, boldly ſcaled the " heavens, and taught us to wield the " artillery of the ſkies, and direct its fire " to aid and reſtore debilitated man, by " its penetrating and nervous energy.

" There is a pleaſure, Gentlemen, I am " perſuaded, you all experience, the pleaſure "of ſeeing the HUMANE SOCIETY "eſtabliſhed upon the baſis of public "utility and approbation; which the "NUMEROUS Eſſays offered for the "HONORARY PRIZES, and the appearance "at this time of perſons whoſe minds "have been enlarged by true ſcience, "unequivocally teſtifies. It is by the "combined and perſevering efforts of "ſuch enlightened characters, that "prejudices unworthy of the capacious "attainments of human intellect, are "ultimately eradicated. The Society, "once oppreſſed by every obſtacle of "unbelief, now affords a proof of what "may be effected by laudable perſeverance, "and amply encourages the purſuit of "great and uſeful objects.

"Many of you know, that the "HUMANE SOCIETY was inſtituted in "the year 1774, to protect the induſtrious "from the fatal conſequences of "unavoidable accidents; the young and "inexperienced from being ſacrificed to

" their recreations; and the unhappy " victims of deſponding melancholy and " deliberate ſuicide, from the miſerable " conſequences of ſelf-deſtruction. I had " the honour, at that early period, of " aſſociating myſelf with its founders; " and I well remember an expreſſion I " made uſe of at that period of its " embryo—*If one life be ſaved within the* " *year, the Society will be eſtabliſhed* " *for ever.*—Little did I then think, that " in the ſpace of a few years, it would be " my proud lot, to have paid the rewards " for the redemption of hundreds of our " fellow-creatures from that bourne, " whence no traveller ever returned, and " my happineſs to have enjoyed the " genuine *auto de fe* of humanity.

" Among the number of great and " good characters, who have extended " *their patronage to the Humane Society*, " ſuffer me to mention, with due reſpect, " our illuſtrious SOVEREIGN, the patron " of ſcience, and the friend of humanity;

" who condeſcended, in the year 1778,
" to accept the gold medal of this
" Society, and graciouſly became its
" immediate patron in 1784.

" THAT INDIVIDUAL *, whoſe
" perſeverance in the cauſe of reſuſcitation,
" is almoſt proverbial; and *whoſe labours*
" *in eſtabliſhing the Humane Society*, have
" been ſufficient to wear down the
" conſtitution of man; hath not relaxed
" in energy, by the acquiſition of almoſt
" incredible ſucceſs: but, like a ſkilful
" General, who redoubles his efforts by
" the proximity of victory, he has excited
" to action, in concert with the Directors
" of that Society, by the diſtribution of
" elegant rewards, the faculties and powers
" of others.

" The eſteem I feel for ſuch a conduct,
" independent of perſonal friendſhip,
" preſſes me to encourage this ſpirit
" of

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* Dr. Hawes.

" of inquiry, that inveſtigation may
" demonſtrate, that the *arcana in exteriore*
" *ſacrario* NON *clauſa ſunt*, to the
" penetrating eye of ſcience.

" Let us recall to mind, upon the
" ſubject of apparent death, the ſtate
" of ignorance from which we are
" emancipated. Had not the ſpring and
" energy of the mind broken the fetters
" of darkneſs, by the application of
" the principles upon which the
" HUMANE SOCIETY was founded, how
" many of our fellow-creatures, whom
" we can now felicitate, would have been
" ſunk in endleſs night! How many
" uſeful ſubjects would have been loſt to
" the community! How many tender
" affections of parent and child, would
" have been denied, and pangs endured!
" How many godlike ſentiments muſt
" you have been deprived of, in witneſſing,
" that the apparently dead have been raiſed
" into exiſtence, and the inanimate maſs
" hath breathed the breath of life!

"Recollect, Gentlemen, thoſe ecſtatic "periods, when you have accidentally "met a friend, whom, from long "abſence, a dubious journey, or a perilous "voyage, you had deemed loſt for ever! "With what ardour you embrace him! "recognize ſome feature or circumſtance "that once endeared him to your heart's "affections! Recollect theſe ecſtacies of "friendſhip, and how muſt your boſoms "riſe with tranſport, in reflecting upon "hundreds, feeling, like yourſelves, the "tendereſt emotions of ſympathy and "comfort; who, by the exertions of the "HUMANE SOCIETY, joyfully exult, "*Is not this our brother who was dead, but* "*now liveth?*

"Impreſſed, as we are, with inſtances "of the uncertainty of life, from "caſualties of every kind, to which "we are liable, the importance of "extending and elucidating the principles "of the HUMANE SOCIETY, muſt

" appear conſpicuous; and he that effects " this, gloriouſly contributes to the " preſervation of his fellow-creatures. It " is therefore, with ſingular pleaſure, that " I diſcharge the taſk aſſigned me by the " HUMANE SOCIETY, and approved by " the MEDICAL SOCIETY, to preſent the " gold medal, bearing this inſcription,

" *Propter optimam Diſſertationem de* " *Reſuſcitatione,*

" to Dr. EDMUND GOODWYN: And to " Mr. CHARLES KITE, the ſilver medal, " inſcribed,

" *Propter eruditam Diſſertationem de* " *Reſuſcitatione,*

" as tributes juſtly due to their induſtry, " abilities, and philanthropy. And I beg " farther to add, that a deciſion in your " favour *, by an inſtitution ſo truly

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* Addreſſing the ſucceſsful Candidates.

“ reſpectable, as the Medical Society
“ of London, when ſo many well-written
“ Eſſays were offered for the judgment of
“ its members, will, I doubt not, ſtamp
“ your merit with the world, and the
“ profeſſion in particular.

“ And I truſt, that the honour now
“ conferred, will lead to more important
“ exertions, to fame and fortune; and
“ that you will feel, in its fulleſt extent,
“ the firſt of all rewards, the internal
“ ſatisfaction of having contributed to the
“ happineſs of mankind.”

THE

PREFACE.

THE moſt ſincere wiſhes for the advancement of views ſo highly commendable as thoſe of the Humane Society, ſtarted the idea of attempting to communicate ſome obſervations and expedients on the ſubject propoſed for their honorary prizes, that might perhaps not otherwiſe be ſo generally known or adverted to. In doing this, however, it is hoped, that the conſideration of more than half the time publicly aſſigned to the performance having elapſed before any reſolution had been formed of engaging in the buſineſs ; and the many interruptions inſeparable from extenſive country practice ; as well as a great variety of more than commonly incidental avocations of a more private nature, having on many occaſions checked the progreſs of the undertaking—will be ſuffered to plead ſome ſort of apology for the numerous inaccuracies and defects, in matter, form, and execution, that the following tract will, no doubt, too juſtly be found cenſurable for. But the delay of, or letting ſlip a promiſing opportunity of contributing to the public good, through the conceited ſelfimportance of fearing to appear diveſted of that form and dignity medical men in general are ſo very much averſe to appear without, would ſurely be more reprehenſible than the moſt awkward manner in the well-intended performance of a beneficial deſign.

Had not the weight of theſe conſiderations preponderated againſt all other apprehenſions, the riſk and inconveniences of the undertaking, ſo much at leaſt as reſpects the preſent inſtance, had not been hazarded. When the chief purpoſes, however, of the ſcheme ſeemed to have been anſwered, by this paper being put into the hands of the Society, and of judges ſo capable and well diſpoſed to embrace every opportunity of conſulting moſt effectually for the general benefit of mankind, and even after this attempt had the good fortune to obtain approbation, ſo far as to be honoured with the ſilver medal of the Society—it had moſt certainly been withdrawn from publication, could my option in the matter have prevailed, or would the Society have permitted ſuch retreat. Repeated applications were made with this view; but my ſolicitations were in vain.

Out of my power of retention, the performance is now under the diſpoſal of the Society, and is humbly addreſſed to the lenity and indulgence of the public, in preciſely the ſame ſtate in which it was delivered for inſpection.

If, however, I may have the good fortune to forward or excite others, poſſeſſed of more abilities and opportunities, to proſecute the improvement of a ſubject ſo beneficial and affecting to ſociety, my wiſhes will have attained their chief expectation. Compleat ſatisfaction cannot, from the very limited extent of human powers, in a ſubject of this kind, ever be expected, as it depends on knowledge, the moſt important, intricate, profound, and difficult, of any in ſublunary concerns;

cerns; and comprehends, either in ſome inſtances remotely, or for the moſt part more intimately and indiſpenſably, a reference to, and acquaintance with, almoſt every part, if not the whole ſcope, of human intelligence; excluſive of many things, wholly beyond the reach of our capacities. However diſcouraging the conſideration of ſuch difficulties may appear to be, we have the ſame conſolation here, as in moſt other things in this imperfect ſtate of being — that there remains within our reach a ſtill practicable and indefinitely progreſſive line of truly beneficial improvement; which it is the duty and intereſt of all, who have convenience and opportunity, to encourage and promote; and was the motive, as we have already intimated, which prompted the production of what it was fancied might be my mite towards that purpoſe.

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ERRATA.

Page 25, line 4, *for* 591 *read* 300.
29, — 3, — 591 — 300.
60, note, line 14, *for* Tilarius *read* Tilaſius.
148, line 4, *for* Dethardengius, *read* Dethardingius.
111, — 12, *add the following note at* Vital heat.

* This ſeems an improper expreſſion. I do not at preſent, however, recollect a better: it is evident all I intend it to ſignify is, that heat which remains in the body after the pulſe and reſpiration have ceaſed.

AN

AN

ESSAY

ON THE

RECOVERY OF THE APPARENTLY DEAD.

APPARENT death, or ſuſpended animation, being the ſubject propoſed for our diſcuſſion, it will be neceſſary to furniſh, between this term and poſitive death, a clear and diſtinct diſcrimination; which I conceive to reſt entirely on the one circumſtance, of the preſence or abſence of the principle of irritability: when it is preſent, however ſtrong may be the appearances of death, and notwithſtanding the vital, natural,

and

and animal functions, may ſeem aboliſhed, animation can only be ſaid to be ſuſpended; but when it is abſent, the body is then to be conſidered as abſolutely and irrecoverably dead.

The powers of life may be ſuſpended by various cauſes: it is moſt probable, each of theſe cauſes may operate in ſuch a manner as to produce a different effect; and conſequently require ſome variation in the method of recovery. The nature of my engagements will not at preſent permit me to examine all of them ſo particularly as I could wiſh: on this account, I propoſe to conſider principally Drowning, as the cauſe of ſuſpended animation which moſt frequently occurs, and which is therefore the moſt important. The others, as more rarely preſenting themſelves, and particularly as they have a greater or leſs connection with the former, will not require to be ſo fully inveſtigated.

ON THE SUSPENSION OF THE VITAL POWERS FROM DROWNING.

On the internal immediate cauſe of death; and the manner in which this is effected, in thoſe who die by drowning.

VARIOUS opinions have been entertained reſpecting this intereſting ſubject; and, notwithſtanding the many experiments and diſſections, which have at different times been performed, with the view of determining the queſtion, it remains nearly as unſettled as it was at firſt. As the moſt eminent of the profeſſion have ſo eſſentially differed, and as their experiments have terminated ſo variouſly, it is evidently involved in much obſcurity. On this account, it will not be improper to recite the principal opinions which have been entertained by different authors; and by attending particularly to each, we ſhall, in all probability, be enabled to form a more ſatisfactory and deciſive opinion on this important and intricate point.

The principal cauſes to which the death of drowned people have been attributed, may be comprehended in the four following.

1ſt, That ſpecies of apoplexy which ariſes from an over diſtenſion of the ſtomach.

2dly, The blood being rendered unfit for performing its offices, by want of the action of the air, in reſpiration.

3dly, Water in the lungs: And,

4thly, A contraction of the parts about the larynx, preventing the air from paſſing into or out of the lungs, and producing death by *a.* The incloſed air being rendered highly phlogiſticated.

b. Suffocation, or a congeſtion of blood about the heart and lungs; or,

c. Apoplexy.

1ſt. Thoſe who have attributed the death of drowned perſons to the firſt of theſe cauſes, have, on diſſection, found the ſtomach much diſtended, from a large quantity of water in it. This over diſtenſion of the ſtomach, they think, would, by preſſing on the aorta, ſtop the paſſage of the blood to the inferior extremities, the veſſels of the brain will then become overloaded, whence apoplexy and death enſue.

That water has ſometimes, and in great abundance, been found in the ſtomach of drowned men, and other animals, will admit of no doubt; but that it is conſtantly, or even generally the caſe, is denied by the concurrent teſtimony of many reſpectable authors; from whoſe experiments it appears, that frequently no water is taken into the ſtomach, at leaſt by no means ſufficient to produce the effect which is attributed to it. Dr. De Haen, in thirteen dogs which he diſſected, found no fulneſs in their ſtomachs; and the experiments which I have made on kittens, in that reſpect, coincide entirely with the Doctor's, for not one drop of water was found in the ſtomach of any of them. As death then is often produced where this cauſe does not exiſt, the arguments which have been built upon it, muſt of courſe fall to the ground.

2dly. It is well known that the blood, in its paſſage through the lungs, undergoes ſome very particular and important change: in what this conſiſts, we are probably not quite certain; the general opinion however, among the moſt celebrated phyſiologiſts of the preſent day, is, that a portion of pure, dephlogiſticated, or vital air, is imbibed from the atmoſphere; and that noxious or phlogiſticated air is diſcharged. If by any means this proceſs is ſtopped, or even impeded, for a very ſhort time, it is ſaid by the ſupporters of this doctrine, that the blood will be immediately overcharged with phlogiſton, or ſome noxious principle; and hence, when it circulates through the brain, and other vital parts, the nerves will ceaſe to perform their office, and the action of the heart and lungs muſt neceſſarily be interrupted.

This idea, however, is oppoſed, and with great ſucceſs, by obſerving, that it would be impracticable ever to recover either drowned perſons or ſtill-born children, on account of the impoſſibility of altering the ſtate of the blood previous to the reſtoration of the circulation. Now the contrary of this, we know, every day happens; for it is no uncommon thing that life is renewed, without any attempt to correct the foul properties of the blood,

by

by imitating natural reſpiration; and the experiments which I have made on animals, ſhew that they frequently recover ſpontaneouſly, ſome time after the vital and voluntary motions have ceaſed.

3dly. In anſwer to thoſe who maintain the third opinion, it will be proper to obſerve, that although water has, beyond doubt, often been found in the lungs of drowned animals; yet that it is frequently abſent, is evident from the experiments of men of undoubted authority. Frothy mucus, now and then mixed with blood, is very generally to be met with in the lungs, and ſometimes in conſiderable quantity, owing to the blood and mucus being forced through the veſſels by the great diſtenſion of the pulmonary artery; and this, I have no doubt, has frequently been taken for water: but if the animals are drowned in water tinged with a colouring ſubſtance, the fact will then be readily aſcertained. Of ten kittens drowned in this manner, not one drop of the liquor was found in, or to be preſſed out of the lungs.

But although it is on all hands allowed, that water is ſometimes in the lungs; yet that it never gets there while life remains, is rendered extremely probable, by recollecting the exquiſite ſenſibility with which the windpipe is endued, and which prevents the ſmalleſt quantity, either of ſolid or fluid, air excepted, from paſſing into it. In the action of deglutition, the opening into the larynx is completely ſhut by the epiglottis; ſo that whatever we ſwallow paſſes over without producing the leaſt inconvenience. This always takes place ſpontaneouſly, and is not in the leaſt dependant on our will. It is therefore natural to conceive, that any quantity of water may, at the time of drowning, be taken into the ſtomach, and yet not one drop get into the lungs.

It is certainly very remarkable, however, that water ſhould at one time be found in the lungs, and at another time not, eſpecially as the epiglottis is always found open, and the paſſage into the lungs conſequently free. Not one drop of water was to be found in the kittens, I have juſt mentioned, although they ſeemed to gaſp under the water, and thruſt out their tongues. Now it is difficult to conceive, how the tongue can be thruſt out, without the epiglottis being at the ſame time raiſed, by the ligament which connects them together: if this elevation does take place, the paſſage muſt, for that time at leaſt, be cloſed by the contraction of the fauces; but this contraction does not probably at all times exiſt, for it often happens that water is found in the ſtomach when there is none in the lungs; and in the action of deglutition, the fauces muſt neceſſarily be relaxed.

The generality of writers ſeem to think, that water is much more frequently found in young than in adult animals: this I cannot allow, as it is in a great meaſure contradicted by my experiments.

Some authors have imputed it to the different conceptions of different people, while in the water; of whom, thoſe who apprehend ill conſequences from taking water into the lungs, by cloſing the glottis, prevent any paſſing into them; and thoſe who have thought that death was occaſioned by want of air, have contrived to open it. Of the great number of perſons that have been recovered, ſince the eſtabliſhment of the Humane Society, we do not find one who ſeemed to be impreſſed with any ſuch deſign; and if they had, I do not ſee how they could put it in execution, as, at the time of drowning, the whole muſcular ſyſtem is thrown into violent agitations, and the mind ſeems, in a great meaſure, incapable of properly regulating and directing our motions. The ſuppoſition is rendered ſtill more improbable, by recollecting that theſe differences have chiefly been obſerved in various animals, to whom it is impoſſible this argument can in any meaſure be applied.

There are others who have endeavoured to explain it, by the difference in the temperature of the water in which the animals are drowned; the cold water inducing ſuch a ſpaſm about the fauces, as to prevent any being either ſwallowed or inſpired into the lungs: and warm water, producing no ſuch conſequences, finds an eaſy entrance. If this be true, it follows, that all drowned in ſummer ſhould have water in their lungs; but that this is not the caſe, we are certainly allowed to conclude, from the readineſs with which many are in that ſeaſon recovered, from whoſe lungs no water has been ejected; nor has any injury in that organ been diſcovered from the conſequences of that accident. With the view of rendering this affair ſtill more evident, one kitten was drowned in water of nearly its own heat; but its lungs, on inſpection, were the ſame as in the others.

It does not appear then, that, at preſent, any probable cauſe has been aſſigned for the uncertain occurrence of water in the lungs; nor, indeed, does it ſeem to have been thought that it would be productive of any material advantage, if it were exactly aſcertained. As we ſhall take an opportunity of diſcuſſing this point more fully in another place, it will be unneceſſary to ſay any thing further upon it at preſent.

4thly. We now come to examine the opinion of thoſe who maintain, that "death is cauſed by the contraction of the parts about the larynx ſtopping reſpiration."

Nature, from the earlieſt period of our exiſtence, implanted in the aſpera arteria the moſt exquiſite ſenſibility, by which the admiſſion of every thing, except air, into the lungs is interrupted. That this influence prevails in health and diſeaſe, in the firſt moments of life, and in the agonies of death, is known to every one; and that it did exiſt while in utero, and that it continues to be exerted during the article of ſubmerſion, is evident, for theſe reaſons—That an inſtance has never been known where the liquor *amnii* had penetrated into the lungs of the fœtus; and water has not always, or even generally been found in the lungs of animals lately drowned: which circumſtances muſt inevitably happen, if a ſtricture of the glottis did not in every inſtance invariably take place.

However plauſible this reaſoning may appear, there are two objections to it, which preſent themſelves; and which, it may poſſibly be ſuppoſed, ought to be anſwered.

The firſt is, that when water is found in the lungs, which it is allowed frequently to be, no contraction could then exiſt: and the ſecond, that in thoſe diſſections made on animals, the epiglottis has always been elevated, and the paſſage into the lungs been found free.

In anſwer to the firſt, it may be obſerved, that the principle of irritability continues in the body a conſiderable time after reſpiration and the circulation have ceaſed; and ſo long as it remains in the muſcular fibres of the epiglottis, and thoſe which lie about the glottis, the contraction we have been ſpeaking of will prevail; but, after an uncertain time, when this power is annihilated, a ſtate of relaxation enſues, the elaſtic cartilage of the epiglottis is then ſpontaneouſly elevated, and water is allowed an opportunity of falling into the lungs.

To the ſecond, it will be neceſſary to remark, that it is ſcarce poſſible to conceive, that the body of any human being was ever opened, at leaſt with this view, till the ſtate of relaxation we have juſt ſpoken of had taken place; and that in other animals, it is probable, the ſame condition may hold good likewiſe: but ſuppoſing ſome degree of irritability to exiſt, we are to take another circumſtance into conſideration; which is, the difficulty of inſpecting thoſe parts; for whoever is acquainted with the ſlender ſtructure of thoſe muſcles, will readily conceive, that without uncommon care and attention in the neceſſary diſſection, much more probably than has uſually been beſtowed upon it, the weak and feeble power of contraction will be deſtroyed; for the leaſt preſſure on the tongue, or motion of the windpipe, at this time, when the irritability is ſo nearly exhauſted, would be ſufficient to elevate the epiglottis.

Allowing then, what is, I think, clearly proved, that death is cauſed by a contraction of the parts about the larynx ſtopping reſpiration—it ſtill remains to enquire, concerning the manner in which this ſtoppage of reſpiration acts, ſo as to occaſion that effect.

This part of the ſubject is inveloped with many difficulties and embarraſſments; and notwithſtanding that it has been attended to by men of the firſt abilities, as yet nothing ſatisfactory or deciſive has been advanced. The appearances on diſſection not being at all times ſo diſtinctly marked, as readily to determine the part principally affected, and various circumſtances having ſometimes conſpired to occaſion a real difference in the appearances, are the cauſes to which this uncertainty is in a great meaſure to be imputed. We will, however, conſider each of the principal opinions, and ſuggeſt ſuch hints as appear either to favour or oppoſe the principles on which they are formed.

a. The incloſed air being rendered highly phlogiſticated.

This idea, which originated with the very ingenious Dr. Fothergill, is ſupported thus: "Air rendered impure by being often reſpired, acquires the ſame deleterious properties, and becomes equally deſtructive to animals, as any other noxious air. Now, if the mere ſhutting out of the former, for a few minutes, ſuſpends the action of the lungs, the retention of the latter cannot but haſten its final extinction. From whatever cauſe reſpiration is ſtopped, a quantity of phlogiſticated air remains ſtagnant in the cells of the windpipe. This, by its ſedative power, ſpecifically exerted on that organ, by degrees deſtroys the remnant of irritability; and thus, though hitherto unnoticed, probably gives the coup de grace, in all caſes at leaſt of the pulmonic kind. Hence, perhaps, may be explained the diſagreeable ſenſe of ſuffocation, which is felt on forcibly holding the breath for a few ſeconds; and why, if this is protracted beyond a certain time, the intolerable anxiety which it excites, becomes at length incompatible with life."

From this quotation, it appears to me, that air phlogiſticated, by remaining in the cells of the windpipe, and air rendered impure by being often reſpired, is to be conſidered as preciſely the ſame, ſince air being loaded with phlogiſton, and from the ſame ſource, is the caſe in both inſtances: hence, as air thus rendered impure certainly does acquire "the ſame deleterious properties, proves equally as deſtructive to animals, and affects them in the ſame manner as that noxious air which ariſes from the grotto del cani, fumes of ſulphur, charcoal, and other bodies which exhale phlogiſton or mephitic air," it follows, that death, in both inſtances, is effected by the ſame means; and conſequently we muſt expect to find the concomitant phœnomena exactly ſimilar. Let us ſee whether this is the caſe.

Animals who periſh on breathing various kinds of noxious air, do not always exhibit preciſely the ſame appearances; but as theſe ſeem to differ more in degree than in any other reſpect, it will not be neceſſary to make any particular diſtinction.

It is obſerved, that they are generally convulſed, and that they are killed ſooner

than

than by ſtrangulation, ſubmerſion, or confinement in vacuo. It is further remarked, that ſuch bodies, inſtead of becoming rigid, remain generally quite flexible, and the blood continues in a fluid ſtate, with ſcarce any tendency to concretion.

Now, in every one of theſe articles, do drowned people exhibit the oppoſite effects: they are not ſo ſoon killed; their joints do become ſtiff; and experience teaches us, that their blood ſoon begins to coagulate.

Travellers inform us, in their accounts of the pearl fiſheries, in the Eaſt and Weſt Indies, of an amazing length of time ſome of the divers are capable of remaining under water, without any ſupply of freſh air: thoſe who are very expert are ſaid to continue in that ſituation half an hour; while thoſe who are not ſo, do not much more than exceed half that time. Whether theſe relations are to be depended upon as ſtrictly true, is matter of little conſequence; but we all know, that thoſe people are certainly endued with the power of retaining their breath much longer than men in general; for, by obſervation, it has been found, that men uſually begin to drown, after being under water about half a minute. Now, ſoon after this period, we ſhould expect, according to the Doctor's theory, that the air in their lungs would become highly phlogiſticated; its baleful and ſedative effects muſt therefore be exerted on the nerves of the lungs, and the intolerable anxiety which it occaſions would become incompatible with life.

To this it may be objected, that thoſe people acquire the property of remaining any conſiderable time under water, by imperceptible degrees, and by long and frequent habits of repetition, and therefore that their lungs are equally as likely to reſiſt the noxious air, as to permit the continuance of the circulation through them. This I allow; and moreover add, what Dr. Prieſtley,

ley, and ſeveral others, have long obſerved; that animals accuſtomed to breathe mephitic air, will live a conſiderable time longer in it, than thoſe who are not; and that thoſe who uſually reſpire pure air, periſh ſooner in noxious fluids than other animals. In anſwer to theſe, it may be ſaid, that although ſome inconvenience may ariſe from this circumſtance, yet the ill effects divers moſt frequently experience, while acquiring this extraordinary capacity, do not ſeem to ariſe from the action of mephitic air on the lungs, but are evidently cauſed by an over diſtenſion of the blood veſſels of the head and thorax; ſuch as hemorrhages from the eyes, noſe, ears, and lungs. To me it appears extremely natural to conclude, that thoſe ſymptoms which are the moſt urgent, would, on the continuance of the ſame cauſe, be increaſed ſo as to occaſion death, rather than that that effect ſhould be produced by a freſh aſſemblage of circumſtances, which, as yet, has cauſed little or no inconvenience.

In order to determine whether there was any difference between air which had frequently been reſpired, and that which had long been retained in the lungs, I made ſeveral experiments:—by expelling all the air out of my cheſt, and keeping the veſicles of the lungs collapſed as long as I was able; then making a full inſpiration, and immediately expiring it into a bladder;—by retaining a certain quantity in my lungs as long as I could, and then expelling it into a bladder;—and, by breathing a ſpecified portion into and out of a bladder for a particular time. The air to be tried was mixed for a certain ſpace of time with an equal quantity of nitrous air; and particular attention was paid, that the nitrous air was always of the ſame ſtrength, and the water in the trough of the ſame temperature. The event of theſe experiments will be found in the following table.

			Scale of Eudiometer.		Hundred parts worſe than common air.
	Air of the room — —	—	60	Standard	—
1	Four or five inſpirations immediately following:—the laſt —	—	58	—	2
2	Seven ditto — — the laſt —	—	58	—	2
3	A full inſpiration immediately expired; the lungs having previouſly remained empty — — —	20 ſeconds	52	—	8
4	Ditto, the lungs remaining empty — —	15 ſeconds	52	—	8
5	Ditto — ditto — — —	20 ſeconds	50	—	10
6	Ditto — ditto — — —	20 ſeconds	45	—	15
7	Air expelled in common reſpiration (17 cubic inches) *	—	49	—	11
8	A moderate inſpiration (104 cubic inches) † retained	20 ſeconds	32	—	28
9	A full inſpiration (300 cubic inches) ‡ retained	72 ſeconds	29	—	31
10	Breathed 104 cubic inches as long as I could, which was	30 ſeconds	27	—	33
11	Ditto — ditto — —	30 ſeconds	24	—	36
12	Retained 104 cubic inches as long as I could, which was	30 ſeconds	26	—	34
13	Breathed 104 cubic inches as long as I could, which was	65 ſeconds	23	—	37
14	Ditto — ditto — —	68 ſeconds	21	—	39
15	Breathed 300 cubic inches as long as I could, which was	72 ſeconds	20	—	40
16	Ditto — ditto — —	130 ſeconds	12	—	48

* In common eaſy reſpiration, I find that I do not take in or expel more than 17 cubic inches at a time; many times not more than 12.

† Although I do not in common take in more than 17 cubic inches, yet I find that the whole quantity of air, at that time in my lungs, amounts to 104 cubic inches.

‡ My lungs, when completely diſtended, for inſtance, when gaping, contain 300 cubic inches.

I could not prevail on myſelf to extend theſe experiments any further, on account of the great inconvenience I experienced from the ſixteenth, where 591 inches were breathed into and out of a bladder, for two minutes and ten ſeconds, which was nearly three times as long as another perſon could breathe the ſame quantity. After the firſt minute, I began to experience great anxiety at my breaſt, which in about half a minute more increaſed ſo as to become almoſt intolerable: my head, which at the time the oppreſſion at the breaſt commenced, appeared to be diſtended began now to prove ſo diſtreſſing as to make me almoſt inattentive to my former ſenſations: my face was ſo much ſwelled, that I could ſcarcely ſhut my eyelids; it was almoſt black, and felt exceſſively hot: every object appeared red, and ſparks of fire were in great abundance dancing before me. The ſight began to fail; great giddineſs in the head, and confuſion in the ſenſes enſued, and at laſt I fell into a chair.

Breathing the freſh air gave me inſtant relief, but for the ſpace of two hours I was ſomewhat confuſed and giddy. To theſe ſucceeded a violent pain in the head, which continued the remainder of the day; but I awoke the next morning perfectly free from any complaint.

With the intention of aſcertaining, as nearly as poſſible, the degree of phlogiſtication which the air receives from the lungs of animals, in the action of drowning, and afterwards when they appeared to be dead, I put a kitten under a glaſs receiver, exactly filled with and inverted into a tub of water: immediately a quantity of air was viſible at the top of the glaſs; a meaſure of which being mixed with an equal quantity of nitrous air, appeared very nearly of the ſame degree of purity as common air. Suſpecting from this, that the air was not expired by the animal, but that it was ſeparated from its hair, or conveyed there ſomehow by the hand, I repeated it ſeveral times with greater care, and I took the precaution of wetting the creature's coat thoroughly, before it was put under the receiver; but the quantity of air was the ſame, and, as before, very little worſe than the common atmoſphere. When the animals were dead, I prepared to examine the ſtate of that air, which, according to the Doctor, remains ſtagnant in the cells of the windpipe: they were therefore very gently and carefully removed from the receiver in which they were drowned, and their heads placed underneath another jar quite filled with water: in this ſituation, their thorax and abdomen were properly preſſed; but not one particle of air eſcaped.

We will now finiſh what we have to ſay on this occaſion, by recapitulating what has been ſaid, and deducing a few inferences from thence.

1ſt. It does not appear that drowned animals are killed by mephitic air acting on their lungs, as the appearances, at the time death ſeemingly takes place, are very different from thoſe who inſpire the ſame kind of air.

2dly. As the inconveniences perceived by divers, after remaining a conſiderable time under water, do not appear to ariſe from the action of phlogiſton on their lungs, it is highly preſumable that their death, were they to remain under water long enough to occaſion it, would not be produced by that cauſe.

3dly. The extreme anxiety which ariſes in conſequence of forcibly retaining our breath, is not cauſed altogether by the action of phlogiſton on the lungs, becauſe, from a compariſon of the ninth with the fifteenth experiment, it appears that the air, in this caſe, is nine degrees purer than that which was frequently reſpired, although the quantity of air, and the time it was uſed (300 cubic inches for 72 ſeconds) was the ſame in both inſtances:

and, by comparing the ninth with the ſixteenth experiment, where the ſame quantity was taken into the lungs, 591 inches, but in the former was retained as long as I was able, and, in the latter, was breathed into and out of a bladder as long and as often as I could—it will be found, that the air frequently reſpired was ſeventeen degrees worſe than that which was retained: and at the time I was making the experiments, I found the anxiety attending N° 16 infinitely more diſtreſſing than that of N° 9: it is therefore not an improper concluſion, that the anxiety, where the breath is retained, or fully expired, ariſes in a great meaſure from an impeded circulation through the lungs, in conſequence of the motion of that viſcus being ſuſpended.

4thly. That all the air is violently expelled from the lungs the inſtant the animal is ſubmerſed, and that none ſtagnates in the cells of the windpipe; conſequently, the death of drowned animals cannot be attributed to the action of phlogiſton on the nerves of the lungs.

It would be impoſſible, at any rate, to paſs over in ſilence a theory ſo ingenious and plauſible; and moreover, as it originated with an authority ſo learned and reſpectable as that of the gentleman juſt mentioned, we were particularly called upon to give it a ſerious conſideration, and ample diſcuſſion. On this account, we have exceeded the bounds at firſt propoſed, and muſt therefore haſten to proſecute the further conſideration of our ſubject.

It appears to us no way unneceſſary to remark, that but few diſſections have been made of drowned perſons, at leaſt very few have been publiſhed; and even theſe have not thrown ſuch light on the affair as might have been expected. In ſeveral inſtances it has appeared, that the veſſels of the brain were not turgid with blood, and in ſome that they were rather empty: in others, no notice is taken of any collection of blood in the heart or lungs; and, in moſt, no particular appearance was diſcoverable, which could be ſuppoſed to be the cauſe of death. This difference in the appearances, on diſſection, may be accounted for by the length of time which has frequently elapſed before the body was opened, having given an opportunity for the blood to be more generally diffuſed, which it certainly will be in a greater or leſs degree, as the humors become cold, and the fibres conſequently contracted. Harvey has an obſervation much to the preſent purpoſe *:

"I have,"

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* Ego aliquando, in cadavere humano noviter ſtrangulato, intra duas horas a ſuſpenſione, aperto pectore et pericardio (antiquam faciei rubor evanuerat) auriculam dextram cordis et pulmones, plurimum diſtentos et infarctos ſanguine, multis atteſtantibus oſtendi; præcipue vero auriculam, ad maximi hominis pugni magnitudinem, turgentem adeo ut diſruptum iri putares. Quæ moles die ſequente, refrigerato penitus corpore, et per alias vias cruore dilapſo, detumeſcens evanuit. Exercit. alter de circul. ſanguin.

"I have," ſays he, "ſometimes in a human body recently ſtrangled, that is, within two hours after hanging, when the cheſt and pericardium were opened (before the redneſs of the face was gone off) demonſtrated to many witneſſes, that the right auricle of the heart, and the lungs, were very much diſtended and ſtuffed up with blood; but chiefly the auricle, to the bigneſs of a large man's fiſt, and ſo very turgid, that you would ſuppoſe it ready to burſt. Yet all this quantity of blood, on the day following, when the body was quite cool, had entirely diſappeared, having flowed down into other paſſages."—This effect will be greater or leſs, as the internal heat may have continued a longer or ſhorter time; and according to the propenſity which the blood has to concrete: both which circumſtances, in different people, we know, vary extremely; the former remaining much longer in one in the middle of winter, than in another during the height of ſummer; and the blood of ſome beginning to coagulate almoſt the inſtant it is taken away, while that of others requires half an hour, nay, even upwards of an hour, to bring it to the ſame ſtate. We ſometimes find the coagulum of ſo looſe a texture, that a probe paſſes through it almoſt without reſiſtance; and, on the contrary, we do not unfrequently ſee it ſo firm and denſe, as by its coheſion to ſuſtain its own weight on the probe. What this variation is owing to, it is of no ſort of conſequence, on the preſent occaſion, to enquire: the fact is extremely evident, as well from what has been ſaid above, as from the great alteration in the external appearance of the body —that the blood continues in the veſſels, where it abounded at the time of death, but a very ſhort time. It may further be obſerved, that the brain, in general, is not examined till the thoracic and abdominal viſcera have been diſſected; in performing which, the great blood veſſels are divided, and their contents are uſually poured forth in great abundance, ſo that if any congeſtion did at that time exiſt in the neighbouring parts, it will probably, by theſe means, be leſſened, if not totally overcome. Theſe, therefore, are to be aſſigned as ſome of the principal reaſons, why the appearances, on the diſſection of drowned people, are ſo different; nay, that they ſometimes may be oppoſite, and yet were originally nearly the ſame.

From what has been ſaid, it ſhould appear, that we are not to expect thoſe material aſſiſtances from the diſſection of drowned people, that we might otherwiſe have imagined; eſpecially at the preſent time, when no ſubject can poſſibly be procured, that has not lain a very long time under water; or, which is leſs likely to anſwer our purpoſe, thoſe on whom means have been employed for reſtoring life, ſuch as heat, friction, and motion: although they may by no means be able to effect a recovery, yet there can be no doubt, but the long perſiſtance in their application may anſwer the purpoſe of overcoming any congeſtion, and of diſtributing the blood more equally throughout the vaſcular ſyſtem.

Animals have frequently been diſſected, as they are more readily procured than human ſubjects; and it may be ſuppoſed the inconveniences I have juſt mentioned will by theſe means be overcome, as we have an opportunity of commencing our examination as ſoon as we wiſh. But, on account of the inequality of the ſkull, the membranes, and even the ſubſtance of the brain, have often been cut into, on ſawing through the cranium; and, for want of making frequent diſſections of animals who have died from different cauſes, we are, in a great meaſure, at a loſs in forming an accurate opinion of the matter.

Having premiſed theſe few obſervations, we may, I conceive, be enabled the more readily to underſtand why opinions have varied concerning the manner in which death is produced, and it will likewiſe aſſiſt us, in ſome meaſure, in finding out the true cauſe: whether it be—

b. Suffocation, or
c. Apoplexy.

Of thoſe who are of the former opinion, Dr. De Haen ſtands theforemoſt; and, as this gentleman profeſſes to have formed his opinion from the appearances on diſſection, it will be proper to attend to what he has advanced in ſupport of it.

On diſſecting a woman who had remained ſeveral hours under water, all the parts of the lungs and breaſt remained entire. Upon preſſing the lungs, the water which had made its way into them, evidently regurgitated by the windpipe: the lungs were entirely black; and the heart void of blood.

On opening the bodies of eleven dogs, which were drowned for the purpoſe, Dr. De Haen, in the ſecond chapter of his Ratio Medendi Contin. informs us, that, in ſeven inſtances, water was inſpired into the lungs; in two, the lungs were free; and in two, the membranes of the brain and lungs were inflamed and diſtended. In the fifth chapter of the ſame book, we are told, that on opening four dogs which were drowned, evident marks of congeſtion were found in the lungs, but no appearance of any in the brain. From his experiments and diſſections, he deduces ſeveral concluſions, and among them this, " that when the brain appears affected, after hanging or drowning, it muſt be aſcribed to an old head-ach, or ſome chronic diſorder."

As it is generally agreed, that the ſtoppage of the motion of the lungs is the firſt internal efficient cauſe of death, let us conſider the effects which reaſon teaches us muſt inevitably follow the ceſſation of that important action.

The blood returning from all parts of the body, by the ſuperior and inferior venæ cavæ, is collected in the right auri-

cle

cle and ventricle of the heart; from whence, in a ſtate of health, it is tranſmitted through the pulmonary artery and veins, into the left auricle and ventricle; but, in the preſent inſtance, the motion of the lungs being ſtopped, only a ſmall quantity can paſs through that viſcus, ſo that the right auricle and ventricle ſoon become full and over diſtended: in conſequence of this, the right ſinus venoſus, and the venæ cavæ will not be able to empty themſelves, and the blood will be accumulated throughout the whole venal ſyſtem; but as the quantity of blood ſent to the brain is infinitely larger in proportion than to any other part of the body*, it neceſſarily follows that the obſtruction of the veſſels of the head, and the ſymptoms depending upon it, will take place ſooner, as well as be more remarkable, than in any other part of the body. And if to theſe conſiderations we add the exquiſitely fine texture of the veſſels of the brain, which far ſurpaſſes that in any other organ, we ſhall conſequently be led to conclude, that the effects cannot fail of being more conſiderable. The jugular veins therefore, and the ſinuſes of the dura mater, which immediately communicate with each other, cannot poſſibly expel their contents into the ſuperior cava, becauſe it is already filled; and the ſame cauſe being extended to the tender and delicate veſſels of the brain, will compreſs its ſubſtance. Hence its faculties will immediately be affected, its functions interrupted, and, finally, its influence over the reſt of the vital, as well as the natural and animal actions, muſt either be ſuſpended or entirely deſtroyed.

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* The quantity of blood ſent to the brain is eſtimated differently by different authors. Malpighi ſays it is at leaſt one-third; many eſtimate it at a ſixth: Dr. Monro will allow that only one-tenth of the whole maſs circulates within the head, which is, according to him, nearly four times more than in any other equal portion of the aortic ſyſtem.

We will now obſerve how far theſe circumſtances are verified by actual practice; and how far the ſymptoms, in ſimilar ſituations, and the appearances on diſſection, favour or oppoſe the theory we have delivered.

In all thoſe drowned people which I have had occaſion to ſee, the face has been remarkably ſwelled, and of a dark red or livid colour; the eyes violently ſuffuſed with blood, enlarged, prominent, and ſometimes ſo protuberating, that the eyelids ſeemed inſufficient to cover them; the features of the countenance generally diſtorted; and the tongue in part thruſt out of the mouth. I appeal to thoſe who have been in the habit of ſeeing drowned people, whether this is not their uſual ſtate: and I aſk, if it is poſſible to proceed from any other cauſe than apoplexy, or an enormous diſtention of the veſſels of the head?

There are but few caſes in the reports of the Humane Society, where notice is taken of the patients account of their ſenſations in the act of drowning, and thoſe are but ſlightly mentioned. It is ſaid, however, that on falling into the water, they immediately loſt their ſenſes, and had not the ſmalleſt recollection of what paſſed, till they appeared tolerably recovered. Not a word is mentioned of oppreſſion, or even anxiety, at the breaſt, or any one ſymptom which can induce us to think that death took place from a cauſe reſiding in the cheſt: but the ſenſes every one agree in allowing to be dependant on the brain; the loſs of them, therefore, muſt be owing to its diminiſhed energy.

Their ſymptoms at the time of recovery, and after life has returned, require our attention, as thoſe parts which have ſuffered moſt from the accident, will exhibit ſymptoms of injury ſome time after recovery, and in this manner may probably indicate the part principally affected by drowning.

Before I attend to thoſe caſes which are generally known, I will notice one which happened ſome time ſince under my own direction, and is quite in point. A man fell overboard, and was taken up without any ſymptom of life: his pulſe and reſpiration ſoon returned; ſome glimmering of ſenſe was likewiſe evident, but in a few minutes he fell into a profound apoplectic fit, from which I expected he would never recover: when, however, he did recover, there was no cough or uneaſineſs about the cheſt; but the head remained heavy and confuſed for ſome time.

One hundred and two caſes are mentioned, where the ſymptoms, at the time of and after recovery, appeared to ariſe evidently in conſequence of the head being affected: and thirty-nine ſhewed ſymptoms of ſome part within the thorax being injured; it is to be remarked, however, that in the greater number of theſe, ſymptoms of the head being affected occurred at the ſame time; ſeveral of them therefore, with equal propriety, might be placed under the former head.

From this account it appears, that the brain is generally affected; but that, now and then, the heart or lungs ſeem to ſuſtain the principal miſchief.

That oppreſſion at the breaſt, with pain and difficulty of breathing, ſhould ſometimes occur, is ſurely as little as can be expected, from the diſtention which the heart and lungs ſuffer in the act of ſubmerſion; and in proportion as thoſe parts are more or leſs weakened or diſeaſed, the effects will be more or leſs ſeverely felt. There are few people in whom the lungs are perfectly ſound: when that is fortunately the caſe, little inconvenience, I apprehend, would ariſe; but in thoſe whoſe heart or lungs have long been in a morbid ſtate, ſuch, for inſtance, as have been affected with angina pectoris, aſthma, conſumption, &c. death may very probably ſometimes take place, by rupturing ſome of their veſſels, before a ſufficient quantity can be accumulated to occaſion a fulneſs of the brain.

I never had an opportunity of diſſecting any perſon who was drowned; and I acknowledge I do not recollect to have read of one inſtance where ſuch appearances were diſcovered, on diſſecting the brain, as were ſufficient ſatisfactorily to account for death. But although this be allowed to be the caſe, at the time of examination, it does not neceſſarily follow, that ſuch a cauſe did not exiſt at the moment of death, or in the ſtate I have juſt deſcribed, ſoon after that event has taken place. But enough has already been ſaid on this head, to account for the different appearances which occur in different ſubjects, and for the abſence of thoſe appearances, the abſolute exiſtence of which has hitherto been looked upon as neceſſary to confirm the opinion I am endeavouring to eſtabliſh.

It will, however, be remarked, that one circumſtance is as yet unaccounted for; which is, that in diſſecting thoſe who have died of apoplexy from other cauſes, blood or ſerum has generally been found extravaſated within the ſkull; and from my own account, ſimilar appearances have not been obſerved in examining the heads of thoſe who have been drowned. I am well aware, this is the moſt important objection which will be raiſed againſt this theory. It has, indeed, hitherto been deemed a deciſive and irrefragable argument againſt it, and, ſo far as I am acquainted, remains unanſwered: but I am of opinion, if we attend properly to the ſubject, we ſhall find this argument will loſe much of its weight, if not be entirely overbalanced.

In every apoplexy which ariſes from an internal cauſe, a prediſpoſition has exiſted for a longer or ſhorter time: hence the veſſels of the brain muſt neceſſarily become weakened and relaxed; they are, conſequently, more readily ruptured, and their contents effuſed, when the force of the circulation through them is by any means conſiderably encreaſed. For this reaſon, it is probable, that the ſame cauſe which produces extravaſation in the brain of one previouſly diſpoſed, would, in another, the veſſels of whoſe brain are in a healthy, ſtrong ſtate, produce only a congeſtion or over diſtention of the veſſels of that part. Indeed, I am much inclined to be of the opinion, that extravaſation from an internal cauſe has never, in any one inſtance, taken place where a diſeaſe in the veſſels, or ſome other prediſponent cauſe, did not exiſt. If, therefore, ſuch prediſpoſition was preſent in a perſon who was drowned, effuſion would, I have no doubt, juſt as readily happen, as when the circulation through the brain is obſtructed by any other means; but if no ſuch cauſe was preſent, then the natural ſtrength and elaſticity of the veſſels would be ſufficient to prevent any ſuch effect from taking place

Compreſſion, I mean from internal cauſes, may ariſe from two ſources—extravaſation, and fulneſs of the veſſels: both of theſe, if ſlight, will produce nearly the ſame effects, only thoſe of the former will depend in ſome meaſure on the part where the effuſion happens; while the latter, acting generally, will affect the whole ſubſtance of the brain, and every part of it will ſuffer; but if the extravaſation is conſiderable, then every part will likewiſe be affected: and thus the two cauſes ultimately operate in the ſame manner.

That the functions of the brain are impaired or deſtroyed ſooner by compreſſion than any other cauſe, appears from a variety of cauſes; for why, otherwiſe, ſhould the moſt alarming ſymptoms often ſucceed a ſmart blow on the head, and ceaſe, frequently, almoſt inſtantly, on a few drops of extravaſated blood being evacuated by a perforation made through the ſkull? and, on the other hand, in thoſe accidents with bad and extenſive fractures, which originated from a much more violent cauſe, where not only the cranium has been depreſſed, and the membranes lacerated, but where even a conſiderable portion of the bone, membranes, and ſubſtance of the brain itſelf, has been deſtroyed, no alarming ſymptoms whatever have followed, and a cure has been effected with but few inconveniences. How can we account for the effect being ſo diſproportioned to the cauſe, but by attributing it to the greater degree of preſſure which the brain ſuffered in that caſe where the bone was ſound, than in the other where there was a large opening for the blood and ſerum to be diſcharged, and thus preventing any conſiderable compreſſion?

A diſproportion is, by ſeveral anatomiſts and phyſiologiſts, ſuppoſed ſometimes to exiſt between the brain and the cavity of the cranium; and that it is ſo, in ſome degree, ſeems probable, from conſidering that the ſutures of the ſkull are now and then found cloſed in young people before the head has arrived at the full ſize; hence its cavity is with ſo much difficulty enlarged, that it is poſſible it may never be able to attain its natural capacity: the brain, therefore, will either be ſtinted in its growth, or preſſed cloſer and firmer to the inſide of the ſkull than it naturally ought to be. To ſupport the propriety of this ſuppoſition, we appeal to the obſervation, that the inner part of the ſkull of ſome people is much more furrowed than others of the ſame age; and this difference may be accounted for, by allowing the brain and dura mater to be preſſed much cloſer to the bone in the one perſon than in the other. Theſe indentations, when conſiderable, prove, that the parts muſt have been in that ſituation a long time: but as we have reaſon to believe that the water which is found in the ventricles of the brain, varies in its quantity, being ſometimes very little, and at others in greater abundance; we ſee the diſproportion may be on ſome occa-

ſions

ſions merely temporary, or at leaſt of no material continuance. Now, allowing theſe circumſtances to be true, and to the beſt of my knowledge their reality has never been diſproved, it follows, that at a time when the bulk of the brain is by any means increaſed, ſo as to be firmly compreſſed by the ſkull, a ſmaller degree, either of extravaſation or fulneſs of the veſſels, will produce exactly the ſame effects as a greater, when the brain is in a contrary ſtate, or when it does not ſo completely fill the cavity of the ſkull, but that it might allow of being ſomewhat diſtended, without any conſiderable compreſſion enſuing. This, in my opinion, proves very fully and ſatisfactorily, not only why the diſtention of the veſſels of the brain may occaſion the ſame effects as effuſion, but why extravaſation may produce only the lighter ſymptoms of apoplexy in one, while an over-fulneſs of the veſſels ſhall occaſion death in another.

As a corroboration of what has been ſaid, I may obſerve, that ſeveral inſtances of ſtrongly marked apoplexy have occurred from various other cauſes, both to myſelf and others, where, on the ſtricteſt ſcrutiny, not the leaſt degree of extravaſation could be found; but in ſome, the veſſels have been remarkably turgid, and in others ſcarce any preternatural fulneſs could be perceived.

The event of my experiments on kittens, have turned out differently to thoſe of Dr. De Haen; for the brain being examined a few minutes after death, its veſſels were loaded with blood: and extravaſation, both under the dura mater, and into the ventricles, appeared ſo evident, that for ſome time I entertained no doubt but it had really taken place; and had I been more intent upon eſtabliſhing a favourite doctrine, than in ſtrictly and ſcrupulouſly inveſtigating the truth, I ſhould have acted imprudently in giving up ſuch an important argument, by making it known that I was miſtaken; for if the head be examined immediately after death, the blood, at that time being fluid, accompanies the knife, falling into every cavity and receſs, before you can poſſibly ſee them in their natural ſtate, and thus affords the ſtrongeſt and moſt lively reſemblance to extravaſation, ſufficient to impoſe on almoſt any one. On repeating the diſſection, however, a great many times, with great care, and at different times, I at laſt diſcovered the deception; and am now convinced, that extravaſation did not in any one inſtance exiſt, but that a great fulneſs occurred in all, except one or two; and that it was not ſo remarkable in them, was probably owing to the examination being deferred longer in them than in the others.

Should thoſe who are of the ſame opinion with Dr. De Haen, object to theſe experiments, as not being ſufficiently concluſive, let them recollect, his experiments are liable to preciſely the ſame objections; for, in ſeveral of the animals I diſſected, and even in thoſe where the congeſtion remained in the head, the heart and lungs were flaccid, and contained but little blood: and the Doctor himſelf, in his Pathological Obſervations, giving an account of a drowned woman, ſays the heart was "void" of that fluid.

It ſeems to me, that ſufficient has already been ſaid on this head to ſatisfy the greateſt unbeliever, that perſons who die by drowning, ſuffer from apoplexy: but, leſt any ſuch ſhould ſtill remain, and eſpecially as this queſtion has never been ſettled before, we will conſider the ſtate of the body in two or three ſituations which ariſe from ſimilar cauſes, and are in their effects nearly the ſame as that we have been treating of; and, as I am perſuaded the more this ſubject is inveſtigated, the plainer and more evident will this circumſtance appear, we may reaſonably expect it will derive additional confirmation from that ſource.

The ſituation of the ſtrangled appears to be very ſimilar to that of the drowned, ſince the death of both is uſually aſcribed to the ſame cauſe—the ſtoppage of reſpiration; although the manner in which it is effected remains a diſputed point. As we ſhall have occaſion to attend more particularly to this ſubject in another place, it will only be neceſſary at preſent to obſerve, that as the appearances of thoſe ſtrangled by the halter, immediately on being cut down, exactly reſemble thoſe of the drowned, and as their death, and the manner in which it is effected, is by De Haen, Haller, &c. allowed to be exactly the ſame—it follows, that the appearances which preſent themſelves on the diſſection of the one (the preſence of water, of courſe, being out of the queſtion) will be nearly applicable to the other.

Morgagni, in a madman who had been ſtrangled, ſaw the veſſels of the dura and pia mater diſtended with black and fluid blood, and the ventricles contained a large quantity of turbid ſerum. He obſerves, that Littre, in a woman who had been ſtrangled by two men graſping her throat, found blood extravaſated on the baſis of the cranium, and into the ventricles. In a thief, whom Pet. Nanni diſſected, and at which Morgagni was preſent, the longitudinal ſinus of the dura mater was ruptured: and Lanciſi ſaw, in perſons who had been ſtrangled, bloody points which appeared in great abundance, and variegated the white ſubſtance of the medullary part of the brain. To theſe I will add but one more, and which is from De Haen: in this he mentions, that the pia mater was very red; under the tunica arachnoidea, a quantity of whitiſh ſerum was found, and the brain appeared interſperſed with many red veſſels.

Theſe inſtances are, I preſume, very ſufficient to ſhew, that the perſons in whom theſe circumſtances were found, died in conſequence of the affection of the brain. Now, if the external appearance of drowned and ſtrangled people ſo exactly reſemble each other; and if their cauſe of death, and manner of dying, is one and the ſame, it certainly affords a ſtrong preſumptive argument, that, cæteris paribus, the appearances on diſſection might prove nearly the ſame in both.

In the inflammatory angina, the parts about the larynx are ſometimes ſo much ſwelled, that reſpiration is much impeded, and the lungs in conſequence cannot have their uſual play. Hence the blood is collected in the right auricle and ventricle; and if the diſeaſe gains ground, the ſame effects follow as were related at page 37, 38, and 39, and the patient will be in the ſame ſtate as the drowned, and thoſe ſuffocated with the halter. That this is not ideal, but that it is founded on experience, is a fact too well known to admit a doubt. From thoſe, therefore, who attribute the death of drowned people merely to congeſtion about the heart and lungs, I would beg to be informed, how it comes to paſs, that patients in the inflammatory angina have their face, lips, and tongue, ſo much ſwelled; their eyes inflamed, and ready to ſtart from their ſockets; and why the ſenſes of ſeeing, hearing, ſmelling, and touching, are gradually deſtroyed, and at laſt they die perfectly apoplectic? Was death produced in the way they conceive it to be, not one of theſe ſymptoms could happen; for the heart and lungs being overwhelmed with blood, would occaſion death, before any affection of the brain could take place.

In the action of laughing, the lungs are dilated, and remain almoſt in the ſame ſtate till the cauſe ceaſes; but while it continues, the blood cannot be tranſmitted freely through the lungs: hence we eaſily account for the redneſs and ſwelling of the neck, face, and head; and if the paſſage through the lungs is long impeded, the brain ſuffers, and apoplexy enſues; which has, on many occaſions, ended fatally. Caſes have often happened of violent ſtraining, and fits of coughing, which are attended with a full and long continued inſpiration, terminating in the ſame manner;

and ſinging, or crying, produce ſimilar effects, although it ſeldom happens they are carried to any dangerous exceſs.

Inſtances, almoſt out of number, might be brought forward in ſupport of theſe arguments; but enough has ſurely been ſaid to ſatisfy the doubts of the moſt incredulous, and fix the wavering mind of the moſt incorrigible ſceptic.

ON THE UNCERTAINTY OF RECOVERY, AND ITS PROBABLE CAUSES.

WHOEVER has paid the ſlighteſt attention in the peruſal of the records of the Humane Society, cannot fail of being aſtoniſhed at the different events in the majority of the caſes there related. Some we find have been reſtored, who were ſubmerſed for half, nay, three quarters of an hour *; ſeveral revived ſpontaneouſly;

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* Caſes 103, 165, 350, 420, 547 *d.* (1) (11).

In referring to caſes of recovery, I propoſe to confine myſelf as cloſely as poſſible to thoſe which are to be found in the Reports of our own Society; the circumſtances of which caſes may at any time be examined into, and the truth of any remarkable or uncommon incident readily aſcertained. Only three quarters of an hour are there recorded as the longeſt extent of time that a perſon was in the water, who was neouſly; and ſome required uninterrupted perſeverance, in the uſual methods, three or

was afterwards recovered. This happened only in one out of upwards of ſix hundred ſucceſsful caſes; and he floated on the ſurface of the water during the whole of the time. Rare and extraordinary as this length of time certainly is, yet it is nothing when compared with ſeveral caſes which are to be met with in medical hiſtories. Kuncknel informs us of a young man remaining perfectly alive for two hours under water. Langhanſius, of a woman who was under water half a day, and was recovered in a ſhort time. M. D'Egly, of a Swiſs diver, who remained in the ſame ſtate nine hours. Pechlin, of the Tronningholm gardener, that was ſixteen; Alexander Benedictus, that was forty-eight hours. Tilarius, librarian to the King of Sweden, wrote the hiſtory of a woman who was three days under water; and Kuncknel, of one three days under the ice, who, when found, appeared full of vigour. The ſame author ſays, I am ſufficiently ſenſible, that in Sweden, no one doubts the poſſibility of retaining life under water for eight days. He then relates the caſe of a painter who fell into the water, where he remained eight days; at the expiration of which, he appeared alive on the ſurface. Gocellinus, nephew to an archbiſhop of Cologne,

fell

or even four hours*, before evident ſymptoms of reanimation appeared: ſome, with the intention of deſtroying themſelves, have plunged into the water while, it is natural to imagine, their mind muſt have been extremely agitated: ſome have fallen in during the paroxyſm of an epilepſy†: and others have lain a conſiderable time, from half an hour to an hour and a half, when

fell into the Rhine, and was not found for fifteen days; when, being laid in a church, in order to be interred, he ſoon returned to life. The laſt caſe I ſhall notice, is that mentioned by the celebrated Mr. Burrmann, of a man who continued under water ſeven weeks, notwithſtanding which, he not only recovered, but enjoyed a good ſtate of health for a great many years after. Although moſt of theſe ſtories are atteſted and vouched for by men of ſenſe and eminence, it is perfectly unneceſſary to ſay, they are by far too extravagant to deſerve the leaſt credit. It is highly probable, however, that there has been ſome foundation for them, and that ſeveral have been obſerved to recover, who have laid a conſiderable time under water, and appeared to be dead.

* Caſes 410, 420, 493, p. 165.

† Caſes 150, 274.

they were taken up without any means being uſed for their recovery[*]. Add to theſe, that the aged[†], and many others of whom there were little hopes, have been recovered: while, on the oppoſite ſide of the queſtion, we are informed, from indubitable authority, that one ſubject had been ſcarce a minute[‡], and ſeveral not more than five minutes, in or under water, who were not recovered. Others we find, with youth, ſtrength, and apparently a good conſtitu-

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[*] Caſes 21, 49, 81, 265, 409, 487, 488, 489.

[†] Caſes 19, 276, (6).

[‡] Caſe 264.—Dr. Houlſton, who ſaw him drowning, gave him immediate aſſiſtance, and ſaw the means applied above two hours, with perſevering aſſiduity.

A captain of the navy, who was preſent when the accidents happened, informed me of two men belonging to the Crown ſtoreſhip, who fell overboard, one a marine, whoſe head was not under water half a minute, the other not more than a minute, before they were taken up; and notwithſtanding the ſurgeon immediately commenced the operations recommended by the Humane Society, and perſevered in their application a conſiderable time, yet they neither recovered!

tion in their favour, who have had the uſual method of treatment immediately employed upon them, and have been irrecoverably loſt! From whence then, it is natural to aſk, does this difference proceed, and to what cauſe is this uncertainty to be attributed*?

In

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* It is evident, that in by far the greater number of caſes, it was not poſſible to fix on the preciſe time the perſon was under water; and the accounts of the different people concerned, in general, ſo greatly vary, that it is no very eaſy matter to reconcile them: under theſe circumſtances, I fear it is the natural bias of human nature, to incline towards the moſt remarkable.

Sufficient attention has not been paid to the ſituation of the perſon, whether he was under the water, or whether he only floated; although, it is plain, this may make a very material difference, as in the former caſe reſpiration is impoſſible, whereas in the latter it may ſometimes take place. This article, which indeed is extremely evident, is placed beyond doubt by ſeveral caſes communicated by Dr. Houlſton of Liverpool: that gentleman mentions no leſs than eight inſtances of perſons, who, after ſinking ſeveral times, have

In many inſtances this difference is readily accounted for. If, for example, the perſon, previous to the accident, had indulged in eating to an exceſs, a much larger proportion of blood muſt be ſent to the head, than ought naturally to be there; if he has drunken, ſo as to cauſe intoxication, the vaſcular ſyſtem will be more diſtended, the determination of blood to the brain will be proportionably encreaſed, and death, in conſequence, be much more eaſily brought about. Again, if the perſon did, at the time of or previous to the accident, labour under any diſorder, it is natural to conceive, that the powers of nature would be ſooner overcome. The event in theſe caſes, I ſay, is readily to be accounted for; but not ſo thoſe who, at the

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have floated for the ſpace of ten minutes, and been taken out with evident ſymptoms of life; three were in the ſame ſituation for fifteen minutes; and ſome who had been in the water a longer time, ſeemed at firſt only in a doubtful ſtate. See Caſes 263, 262, 264, 152, 337. Reports for 81, pages 101, 102, 103.

the time of the accident, are in a ſtate of apparent good health.

Having, in a preceding chapter, inveſtigated the cauſe of death in drowned people, it follows, whatever that cauſe may be, that, according as the conſtitution of the perſon was leſs or more prediſpoſed for ſuch a ſtate, he will bear being a longer or ſhorter time under water, before the real ſtate of death takes place. What we have already advanced on this part of the ſubject, ſeems to have clearly demonſtrated, That the general and moſt prevailing condition of the body, under theſe circumſtances, is a compreſſed ſtate of the brain, and conſequent apoplexy; therefore thoſe who, at the time of the accident, have any cauſe exiſting in their habit, which prediſpoſes the body towards a compreſſed ſtate of the brain, or an apoplexy, will be the perſons who muſt firſt loſe the appearances, at leaſt, of vitality. On this account, it will be proper to enumerate thoſe peculiar circumſtances, which have been obſerved to occaſion a prediſpoſition to that affection; and, as the manner in which they may operate, ſo as to produce that effect, will, I imagine, be readily underſtood, I ſhall ſatisfy myſelf with merely mentioning them, and refer thoſe who require any further information on this part of the ſubject, to the numerous writers on that diſorder.

Large heads.
Short necks.
Corpulency.
Indolent life, with full diet.
Frequent intoxication.
Plethoric conſtitution.
Suppreſſion of uſual evacuations.
Advanced ſtate of pregnancy.
Polypous concretions.
Tumors within the ſkull.
Hydropic diatheſis;
In thoſe eſpecially above 50 years of age.

Apoplexy ſometimes comes on very ſuddenly, and without any warning: it is, however, frequently preceded by various ſymptoms, which indicate the diſeaſe to be at hand. When it is known any of theſe have appeared, in conſtitutions prediſpoſed, previous to the accident, and where any of thoſe cauſes which have uſually been obſerved to excite that diſeaſe have occurred, we have, I think, every probable reaſon to expect, that ſuch perſon will almoſt immediately ceaſe to ſhew any appearances of life.

The principal antecedent ſymptoms, which are enumerated by authors, are the following:

Frequent fits of giddineſs, or ſwimming in the head.

Tingling, or tranſitory numbneſs in the limbs.

Singing in the ears.

Great dulneſs.

Frequent fits of incubus.

Frequent head-achs.
Falſe viſion.
Loſs of memory.
Deep ſleep.
Troubled dreams.
Great fulneſs of face.
Frequent interruptions of ſeeing and hearing.
Faltering in ſpeech.
Drowſineſs.

The exciting cauſes are:

Violent exerciſe and exertions.
Paſſion.
External heat.
Intoxication.
Long ſtooping with the head down, or any impediment to the regular and cuſtomary return of the blood from the head to the heart; whether from external compreſſion, or from internal ſpaſm, obſtruction, debility, or other hindrance to the action of the veſſels

ſels in the vicinity of the heart and lungs.

It would be eaſy to point out the mode in which all and every one of theſe cauſes act, ſo as to induce a ſtate of apoplexy: accounts of theſe are, however, ſo very generally to be met with in authors who have written on this affection, that it will be perfectly unneceſſary for me to enlarge upon them in this place.

Some caſes are related, where, on recovery, greater inconveniences were experienced from an affection of the lungs, or ſome part within the cheſt, than in the brain: this, as was ſaid before, in all probability was occaſioned by the diſeaſe in thoſe parts; and as we have ſeen, that the blood is accumulated in great abundance in the right auricle and ventricle of the heart, and in the pulmonary artery, before the brain ſuffers, it follows, that if any diſeaſe exiſts in, or is intimately connected with, thoſe vital organs, death will very ſoon be brought about, either directly and immediately, from a rupture of ſome of the parts in the thorax, or elſe ſecondarily and conſequentially, from the compreſſion of the brain being effected ſooner, and with greater difficulty removed; hence, as every diſeaſe to which thoſe parts are ſubject, impedes either the circulation or reſpiration, their preſence muſt, according to their violence, in a leſs or greater degree expedite the fatal event: either in one way or the other, therefore, or by a concurrence of both, may be explained the manner in which all the diſeaſes affecting the heart, lungs, or great blood-veſſels, conduce to affect the brain.

Various other circumſtances do likewiſe occur, and thoſe not unfrequently, which may either materially impede, or totally prevent the recovery. Theſe are—1ſt. Intoxication. A moderate quantity of liquor, in habits not over irritable, would probably be not only innoxious, but, by increaſing the vires vitæ, might act as a preventive: but how nearly intoxication reſembles apoplexy, is well known to every one; indeed, when carried to exceſs, it conſtitutes one of the moſt violent ſpecies of that diſorder. The brain, therefore, being already compreſſed, and the body debilitated, a ſhort immerſion would ſoon occaſion the vital actions to be ſuſpended. —2dly. Great diſtention of the ſtomach, either from a hearty meal, or from a large quantity of water being ſwallowed: this, by acting in a manner ſimilar to what was mentioned at page 5, although it may not produce the effect there deſcribed, will, by interrupting the flow of blood to the inferior extremities, detain it longer in the veſſels of the brain than would otherwiſe be the caſe.—3dly. When the perſon has ſunk in very deep water, the additional preſſure on the ſurface of the body will ſooner repel the blood to the heart and lungs.—4thly. When the accident has happened in very cold water, or when the body, on being taken up, has lain for ſome time expoſed to the cold, damp air; under theſe circumſtances, the veſſels of the trunk and ſurface being ſuddenly braced, an over-proportion of blood will be ſent into the veſſels of the brain, which veſſels cannot be ſo much affected by the cold, on account of the intervention of the cranium. Cold, beyond a certain degree, acts in every conſtitution as a ſedative, but ſooner and more powerfully when the body is by any means debilitated: thus, thoſe who are weak from preceding diſeaſe, from faſting, fatigue, evacuations, or a debauch, appear to ſuffer principally from cold.—5thly. Extravaſation within the cranium. Although this has not been proved by diſſection, yet there can be little doubt but it does ſometimes take place, eſpecially when diſeaſe in the veſſels, or ſeveral of the prediſponent cauſes of apoplexy, have occurred: when this does happen, except it be in the moſt trifling quantity, I do not perceive how a recovery can with any propriety be expected, for it does not appear that there is any poſſibility of removing the cauſe;

and till that can be effected, muſt not all our endeavours to reanimate prove ineffectual? But, as there is no indubitable ſymptom, by which we can be certain when this circumſtance does exiſt, we ſhould by no means, on a preſumption that it may be the caſe, quit our operations till the full time directed by the Society is elapſed.—6thly. Contuſions on the head or ſtomach often happen on falling into the water: it is impoſſible to know what injury is occaſioned by theſe; but, as even trivial blows on the head ſeldom fail of producing giddineſs, or momentary confuſion in the ſenſes—and as a ſmart blow on the ſtomach has often occaſioned inſtant death—the chance of recovery will certainly be leſs, eſpecially when the contuſion has been conſiderable.—7thly. Epilepſy, palſy, and other affections of the brain. As in the brain of epileptic patients there is often found tumors, effuſions, and various preternatural appearances; and as a fit is often induced by any great emotion of the mind, eſpecially terror; death may very likely be precipitated by one or both of theſe circumſtances. Dr. Cullen is of opinion, that the apoplectic ſtate, which in ſome degree accompanies, and almoſt always ſucceeds, an epileptic paroxyſm, does not depend upon compreſſion, but upon a certain ſtate of immobility of the nervous power: his method of reaſoning may therefore account why ſome, who were ſubmerſed for a few minutes *, during a fit, have been, contrary to what might be expected, taken out with ſome ſymptoms of life. The intimate connection between palſy and ſome other diſeaſes of the brain, and apoplexy, is apparent from their running ſo frequently one into the other; and this is a ſufficient reaſon for preſuming, that thoſe people who labour under theſe diſeaſes will ſoon ſuffer.—8thly. Improper treatment. The practice of ſuſpending by the feet, although recommended

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* Caſes 150, 274.

mended by Dr. De Haen, and very lately in the Reports of the Humane Society, is, as well as rolling in or over a caſk, by no means ſo frequent as hitherto: ſtill, however, they are both, in the abſence of medical men, ſometimes practiſed; and in the hurry and confuſion which generally accompanies theſe accidents, the drowned, while carrying on ſhore, and removing to a convenient ſpot, is but too often laid in ſuch a poſition, that his head is thrown either on the breaſt, or almoſt on the back. Suſpenſion by the feet will undoubtedly increaſe the preſſure on the brain: rolling over a caſk, and ſimilar rough uſage, will produce the ſame effect, and may likewiſe tend to deſtroy the organization of the brain, and other vital parts: and where the neck is either bent forwards, or extended backwards, the paſſage of the blood through the jugular veins will be prevented, and the veſſels of the brain will remain over diſtended.

We have thus accounted for a great number of inſtances that may be expected to turn out unfavourably, in a very ſhort time: ſtill, however, it remains to ſhew, what we are to apprehend in thoſe who neither appear to be diſpoſed to apoplectic or thoracic complaints, nor to be in the ſituation of thoſe we have juſt deſcribed.

It appears to me, and I have long been of the opinion, that this circumſtance may be explained by the difference in the conſtitution of the perſons affected.

Have we not every day, in the courſe of our practice, occaſion to obſerve the different effects the ſame medicine has on different patients? Do we not know, that one perſon ſhall require ten or twenty grains of emetic tartar, to produce the ſame effects which a quarter of a grain will in another; and that a dram of jalap does not purge ſome more than a few grains of rhubarb do others? Do we not ſee that one of a phlegmatic habit will bear a ſevere electrical ſhock half an inch long, equally as well as another of an irritable habit will one of the tenth of an inch? Ten drops of the thebaic tincture will procure as much ſleep for one, as the ſame number of grains of the extract will in another: a pint of wine will intoxicate one man, while another will drink more than a couple of bottles, and feel little or no inconvenience. That bark ſometimes purges, and at other times binds; that acrid humours, or worms in the inteſtines, occaſion violent convulſions in one perſon, and not in another, is known to every one. I have known two grains of calomel throw a woman into a ſalivation; and I have given upwards of half an ounce of calomel, and uſed near two ounces of the ſtrongeſt mercurial ointment, to a child eighteen months old, without producing *any* perceptible effect: and in this way might we go through the whole materia medica. What then can theſe uncertain effects depend upon, but the leſſer or greater degree of irritability of the moving fibres; or, in other words, on the difference in the conſtitution? Is it not therefore in the higheſt degree probable—may we not go ſtill further, and ſay, is it not evident—if the ſame medicine produces different effects in different perſons, that, upon the ſame principle, ſubmerſion muſt be longer in deſtroying animal life in one than in another?

The doctrine of temperaments, or conſtitutions, has of late been much diſuſed, owing to the ancients having diſtinguiſhed them according to the nature of the humours, which they conceived to be predominant, and in which they conceived the cauſe of all diſeaſes to reſide: thus we have the—choleric, phlegmatic, ſanguineous, and atrabilious—the hot, cold, moiſt, and dry temperament, according as bile, phlegm, blood, or atrabilis, was ſuppoſed to abound; or as it was believed to poſſeſs a greater or leſs degree of heat, or a larger or ſmaller proportion of watery fluid. The phænomena of the animal economy being now much better explained, by conſidering the ſtate and affections of the ſolids, or moving powers, that diſtinction, with the ſyſtem on which it was built, is at this time pretty generally diſcarded. Some mode, however, of diſtinguiſhing the different ſtates of the body, in different people, is, without doubt, very uſeful on ſeveral occaſions; indeed, without having recourſe to ſome ſuch method in the preſent inſtance, I ſhall not be able to make myſelf properly underſtood:—but, as I do not recollect any one who has profeſſedly treated on this ſubject, ſince the humoral pathology has been exploded, it appears really neceſſary to form ſome arrangement, conſiſtent with the ſyſtem of the preſent day, which refers every thing to the ſolids, and views the fluids merely in a paſſive light. Much as I believe this to be wanting, it is far from my preſent intention to enter particularly, or extenſively, into the conſideration of this ſubject; all I wiſh for is, to make myſelf perfectly intelligible, and to enable others, who are inclined to pay attention to this part of their profeſſion, to decide, with tolerable readineſs, to which claſs thoſe perſons, who may fall under their direction, are to be referred. But to do this, I find, that however averſe I may be to introduce new terms, yet, under the preſent circumſtances, ſome ſuch become indiſpenſably requiſite: without any further preface or apology, therefore, I ſhall take the liberty to diſtinguiſh the temperament, or conſtitution, into the three following claſſes.

I. The *Tonic*—indicating ſtrength, firmneſs, and vigour in the muſcular fibres.
II. The *Atonic*—denoting weakneſs, relaxation, and inactivity.
III. The *Irritable*—exhibiting quick, lively, and impetuous motions.

I find myſelf unequal to the charge of conveying that perfect, clear, and diſtinct idea,

idea of theſe different conſtitutions, that I would wiſh to do: words, however well ſelected, or in whatever manner they may be combined, appear to me not ſufficiently expreſſive; although it is certain, that every one who attentively engages in the actual exerciſe of the medical art, forms to himſelf a tolerably diſtinct perception of them, and regulates his practice accordingly. Having therefore given the outlines, I might probably be induced to leave them to be filled up by the ſkill of the reader: as this, however, would be quitting the ſubject in too unſettled a ſtate, I ſhall briefly mention the leading circumſtances; for the minutiæ, after all, muſt be left to the diſcretion and taſte of every individual.

In the *Tonic* conſtitution, the make is ſtrong and robuſt; the muſcles firm, large, and diſtinctly marked, covered either with a ſmall or moderate quantity of cellular membrane; the hair dark, thick, and abundant;

bundant; their complexion dark, and ſometimes red, with a firm, or fierce, and reddiſh eye: the external veins are many and large; and their pulſe is ſlow, full, and ſtrong. They are not quickly excited, but their actions are vigorous; they are laborious, capable of great exerciſe, and are of vaſt ſtrength. Their temper is generally very equal; hence they are either friendly and ſincere, or quite the reverſe; and, if offended, revengeful and inflexible: their ſpirits are good and regular; their ſenſibility not in the extreme. The diſeaſes to which they are ſubject, are almoſt always of the inflammatory kind; and they are very violent when they do occur, as the ſtrength of the conſtitution prevents their being affected by trivial cauſes.

The *Atonic* conſtitution is entirely and exactly the reverſe. They are weak, often corpulent, and their muſcles, although they may be large, are ſoft and flaccid, having a large quantity of adipoſe membrane interſperſed among their fibres. Their countenance is heavy, and void of expreſſion, of a pale, ſallow, or white hue; their hair thin and light; and their eyes dull. The external veins are few, and ſmall; and the pulſe ſoft and low. Their perſeverance in purſuits is ſometimes aſtoniſhingly great; but they are in general indolent, and of a pliant diſpoſition. They are dull, and unthoughtful: their ſenſibility is but little; and ſuch people are ſuppoſed to be peculiarly inclined to cowardice, fear, and avarice. They are ſubject to all the diſeaſes which depend on relaxation, which are therefore more obſtinate and tedious, than ſevere or violent.

The *Irritable* conſtitution is by far the moſt common. The make is uſually delicate and ſlender; though there is ſometimes a good quantity of adipoſe membrane. The features of the countenance are ſtrongly marked: the ſkin is commonly fair, ſoft, and delicate; the eyes keen, penetrating, bright, and clear, often blue, and the pupil frequently dilated. Their external veins are not remarkable either in number or ſize; the pulſe contracted, frequent, and eaſily quickened. Their diſpoſition is lively and enterpriſing: all their ſenſes are extremely acute; and their paſſions are readily excited: they are light, inconſtant, and fickle; their ſpirits are either very high or very low; and their propenſity for pleaſure is very great. Their diſeaſes are principally of that kind which is called nervous; but they are ſubject to glandular complaints, ſcrophula, and conſumption.

It is impoſſible to ſuppoſe, that every conſtitution we meet with, will fall immediately under any of the above heads; on the contrary, it is to be expected that very few will occur, ſo diſtinctly marked as to belong to one only; we ſhall find they are in general much blended together, yet not ſo much confounded, but that with attention we ſhall readily be able to determine which is the moſt predominant, and conſequently to which claſs it ought to be referred.

We cannot but obſerve, in the tonic temperament, the general concurrence of every circumſtance which can contribute to the action of the heart and arterial ſyſtem. Such people are alſo in a ſtate very nearly allied to a plethora; hence the blood circulates with ſuch force, as to occaſion hæmorrhages from many parts of the body; and the brain, from the ſuperior delicacy and fineneſs of its veſſels, being likely to have a ſuperabundance of blood in it, will likewiſe be diſpoſed for hæmorrhagy, and will eaſily be compreſſed, if not ruptured, as ſoon as any cauſe is applied which prevents or obſtructs the circulation through them. As ſubmerſion, therefore, produces that effect, this is the conſtitution which will be moſt likely to ſuffer ſooneſt.

We have ſeen the various effects the ſame articles have on different people;

and if we attend, ſhall find thoſe who are the moſt eaſily affected, are ſuch as have their nervous ſyſtem very ſenſible and delicate. This ſtate of the nerves peculiarly conſtitutes the *Irritable* temperament.

The mind, likewiſe, of people belonging to this claſs, are as eaſily irritated as their bodies ; all their ſenſes, as was ſaid before, are extremely acute ; their paſſions are readily excited, they are much agitated by them; and they ſuffer the moſt from the violent tranſports of the ſoul. All their paſſions are carried to an exceſs, and we are frequent ſpectators of the alarming conſequences produced by them.

Of all the violent emotions of the mind, terror ſeems to be productive of the moſt ſerious and fatal conſequences : violent tremors, palpitations of the heart, fainting, and convulſions, we every day meet with from that cauſe. Inſanity, loſs of ſpeech, epilepſy, palſy, apoplexy, and ſudden death, are but too often found on record, to allow the leaſt doubt of their frequently happening. From the paleneſs of the face, the lividity of the lips, and the palpitation of the heart, it ſeems probable, that a contraction of all the ſmall veſſels inſtantly takes place, and that the blood is thrown upon the heart and lungs ſo ſuddenly, as to put an immediate ſtop to their motion. The proximate cauſe of death in theſe caſes, however, has not been clearly aſcertained by a ſufficient number of diſſections; but the ſymptoms indicate the brain to be affected: and as the jugular veins have been obſerved to be remarkably diſtended and puffed up; as the veſſels of the brain and pia mater have been found loaded with blood; as much ſerum has been extravaſated, both into the ventricles of the brain and between its membranes; and, eſpecially, as ſome people have been thrown into a perfect apoplexy; it is highly preſumable, when it does prove fatal, that the patients die apoplectic.

The horror and diſtreſs a man muſt ſuffer, conſequent to falling into the water, where inevitable deſtruction is ſo very evident, can more readily be conceived than expreſſed; and it is very likely that, in every inſtance, it may in ſome meaſure tend to expedite the fatal event: but when the unfortunate ſubject is of that habit juſt deſcribed, which we know to be peculiarly diſpoſed for the moſt violent exertions of the paſſions, and in which it is apt to produce the greateſt effects, it is evident that their death will be very conſiderably accelerated by it, eſpecially as it ſeems to operate in the ſame manner as ſubmerſion itſelf.

Perſons of the irritable conſtitution, therefore, who are ſo readily and violently affected by cauſes too ſlight to make any conſiderable impreſſion either on the body or mind of thoſe of a different conſtitution, will, upon preciſely the ſame principle, be much ſooner deſtroyed by drowning, than thoſe whoſe nerves are leſs delicate, and are with greater difficulty excited.

As the atonic conſtitution is leſs connected with apoplexy than the tonic, and as the nervous ſyſtem is not to be rouſed into ſuch violent actions as in the irritable; it appears that this habit or temperament would allow of being under water longer than either of the former.

It has already been remarked, that the three conſtitutions are moſt generally mixed together: the event in theſe caſes may be predicted, by conſidering the proportion in which they appear to be united; if, for example, an inſtance could occur, of a ſtrong athletic conſtitution being joined to an exquiſitely nervous ſyſtem, we ſhould have juſt cauſe to expect, if what has been ſaid is true, that death would almoſt immediately take place; and, on the contrary, where the tonic, the atonic, and the irritable, are ſo equally blended and ſo exactly adjuſted, that neither are remarkably predominant (and many ſuch are, I think, to be met with) I ſhould for the ſame reaſon conclude, theſe would reſiſt the effects of ſubmerſion a greater length of time than any other modification of the habit whatever.

The reaſon why ſome people exhibit ſymptoms of life almoſt directly, and that others do not, even for ſome hours after they are taken out of the water, appears to be accountable for principally by the degree of irritability in the conſtitution. It appears, from many experiments, that this peculiar property is capable of being excited after death with greater eaſe or difficulty, according as the animal was more or leſs irritable during life. We have already ſhewn, that thoſe who are much ſo, are extremely liable to be ſpeedily drowned; and, for the ſame reaſons, they will be ſpeedily recovered: on the contrary, thoſe of an atonic habit, as they are longer in drowning, will be longer before they are recovered *.

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* M. Bucquet found, that the moſt irritable are the moſt eaſily ſuffocated, and are moſt eaſily revived. They appeared alſo to ſuffer leſs afterwards from the ſuffocation to which they had been ſubjected.—Hiſt, de la Soc. R. de Med.

AN ATTEMPT TO ASCERTAIN WHETHER THERE BE ANY POSITIVE SIGN OF THE ABSOLUTE EXTINCTION OF LIFE.

HAVING aſcertained the cauſe of death, and aſſigned ſufficient reaſons for the difference in the event of the generality of caſes, and likewiſe for the uncertain time in which life reappears in different people, it may be expected we ſhould now proceed to the method of recovery. Previous to this, however, it will not be improper to enquire, "whether there are any poſitive ſigns of the extinction of life?" On a queſtion of ſuch importance, volumes might be written: the nature, however, of the preſent undertaking, prevents my entering minutely into the ſubject; my obſervations will therefore be but few; they will be confined as cloſely as poſſible to facts, and as little connected with theory or hypotheſis as the nature of the ſubject will permit.

Many, various, and even oppoſite appearances, have been ſuppoſed to indicate the total extinction of life. Formerly, a ſtoppage of the pulſe and reſpiration were thought to be unequivocal ſigns of death: particular attention in examining the ſtate of the heart and larger arteries; the flame of a taper, a lock of wool, or a mirror applied to the mouth or noſtrils, or a cup of water to the ſcrobiculis cordis; were conceived ſufficient to aſcertain theſe points: and great has been the number of thoſe who have fallen untimely victims to this erroneous opinion. Of late, ſome have formed their prognoſtic from the livid, black, and cadaverous countenance: others, from the heavy, dull, fixed, or flaccid ſtate of the eyes; from the dilated pupil, the foaming at the mouth and noſtrils, the rigid and inflexible ſtate of the body, jaws, or extremities;

tremities *; the intenſe and univerſal cold, &c. Some, conceiving any one of theſe ſymptoms as incompetent and inadequate to the purpoſe, have required the preſence of ſuch of them as were, in their opinion, the leaſt liable to error: but whoever will take the trouble of reading the Reports of the Society with attention, will meet with very many inſtances, where all the appearances, ſeparately,

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* It will be neceſſary to diſtinguiſh between the contraction ariſing from ſpaſm, and that rigidity which ariſes from the inelaſticity of the fibres in conſequence of death. It is well remarked by Dr. Cogan, that "the limbs are extremely flexible immediately after ſudden death, whilſt the body retains any internal heat: but in theſe caſes the members do not become ſtiff, or the joints inflexible, until the humours are coagulated, and the fibres rendered rigid by the cold of death. If therefore any reſiſtance is obſervable in the limbs, ſoon after a perſon has apparently been ſtruck with death, it is to be preſumed, that there are ſome latent remains of life, and that the members are inflexible from a ſpaſm in their muſcles."

ſtately*, and even where ſeveral aſſociated in the ſame caſe, occurred, and yet the

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* Inſtances of black, livid, or cadaverous countenance, may be found in the following caſes: 2, 10, 11, 21, 22, 43, 51, 52, 54, 63, 67, 100, 101, 117, 130, 164, 238, 239, 240, 242, 244, 256, 265, 268, 278, 282, 312, 314, 324, 357, 358, 393, 396, 411, 415, 423, 424, 432, 435, 437, 445, 446, 496, 501, 561.

Eyes fixed or obſcure, Caſe 1, 22, 57, 101, 111, 162, 240, 242, 268, 411, 492.

Even the eye-balls may be diminiſhed in ſize, immoveable, and fixed in their ſockets, and the cornea without luſtre, and yet the patient recover; as is evinced by the 411th Caſe. Dr. Whytt remarked, in an apoplectic boy, whoſe breathing was very laborious, and his pulſe ſmall and quick, that his eyes were more *ſhrivelled* than they uſed to be in thoſe who have been ſeveral hours dead.

Foaming at the mouth, Caſe 341, 379, 393, 424, 10, 11, 44, 69, 78.

Rigidity of the body, jaws, or extremities, Caſe 5, 10, [28, 46, 50, 53, 67, 100, 103, 111, 241, 260, 268, 258, 162, 314, 357, 370, 393, 410.

Partial or univerſal cold, Caſe 2, 5, 11, 14, 19, 21, 28, 44, 46, 50, 51, 52, 53, 57, 65, 67, 81, 89, 98, the patient recovered: it is therefore evident, that theſe ſigns will not afford certain and unexceptionable criteria, by which we may diſtinguiſh between life and death.

Dr. A. Fothergill, in his very elegant and intereſting letters, has the following obſervation: "One mark of the extinction of life which generally preſents itſelf, and which cannot fail to attract the notice of every accurate obſerver, is a peculiar *glaſſineſs* of the eyes; when this is accompanied with coldneſs and flaccidity of the ſkin, it will ſeldom deceive us. Another ſign, which deſerves our particular attention, is, when air blown into the mouth paſſes without interruption through the whole alimentary canal."

The information we derive from the appearance of the eyes, as to the ſtate of the body and the mind, both in health

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98, 100, 110, 111, 115, 117, 118, 166, 237, 241, 257, 258, 260, 278, 303, 314, 316, 320, 349, 357, 410, 416, 501.

and ſickneſs, is very conſiderable: this naturally induces us to expect, that much benefit will be derived by obſerving the phænomena which they exhibit in the preſent caſe. With this perſuaſion, I have paid particular attention to them in every inſtance of this kind to which I have been called; how far I have ſucceeded, will preſently appear. It is only requiſite, in this place, for me to mention, that a bright, gliſtening, and tranſparent eye, I have generally met with in ſubjects who never recovered; but I have obſerved preciſely the ſame appearances in thoſe whoſe circulation had been ſtopped, but were afterwards renewed. Indeed, Mr. Church, of Iſlington, has obſerved, "in all the caſes which have fallen under his inſpection, that when the cornea of the eye was opaque or miſty, the party was irrecoverably dead; but whenever it remained *clear* and *tranſparent*, they have been reſtored, although no other favourable ſymptom appeared." Notwithſtanding

ing this gentleman's obſervation could not ſtand the teſt of later experience, it is a proof ſeveral have recovered under his direction, where the eye was in that ſtate which I conceive Dr. Fothergill means by the term *glaſſy*. There are two other caſes, and I believe only two, recorded in the Reports of the Society, unfavourable to the Doctor's opinion. In caſe 258, it is ſaid, " there was great ſtiffneſs in the extremities, and univerſal coldneſs; the cornea conſtantly remained clear and tranſparent." In the 96th caſe, Dr. Houlſton ſays, " the heat was much leſs than natural; the eye *ſet* and *glaſſy*." Dr. Whytt, relating the hiſtory of a boy who was ſeized with the apoplexy, ſays, " his pulſe was full and quick, and his eyes had ſomething of a *glazed* look." Now, although I cannot produce a ſingle inſtance of recovery, where the glaſſineſs of the eyes was combined with coldneſs and flaccidity of the ſkin; yet, what has been ſaid, in my mind, militates ſo powerfully againſt theſe appearances, that little confidence ought to be placed in their preſence.

I have, in more than one caſe, where there was every reaſon to imagine life had really been extinguiſhed ſome time, endeavoured to make the air thrown into the noſtril paſs through the whole alimentary canal. This, Dr. Cogan, with whom the idea originated, obſerves he has effected ſeveral times in ſtill-born children. However, I could not ſucceed in the experiment; and indeed I am of opinion, if the ſtomach and inteſtines were removed from the abdomen, that effect would not, in general, be produced without conſiderable difficulty.

Favourable concluſions have been predicted from—the natural colour of the countenance—the fluidity of the blood—the flexibility of the joints—the contraction of the ſphincter ani—and from the clear and tranſparent ſtate of the cornea.

In reply to theſe I anſwer, that, in the 264th Caſe of the Reports of the Society, Dr. Houlſton, after mentioning that, from the length of time, there ſeemed no proſpect of ſucceeding, yet the neceſſary ſteps had been purſued, obſerves, that no ſign of life appeared, though the face had all along preſerved the natural colour. Mr. Portal, in his account of two people who had been ſuffocated by charcoal, ſays, at the time he ſaw them, their faces were coloured, and their eyes bright. And it is no uncommon remark, that the countenances of ſome people look much better, and more natural, when dead than while alive.—2dly. It is well known to anatomiſts, that the blood, in many ſubjects, does not coagulate after death, but remains perfectly fluid: if a vein, therefore, is opened in any of theſe, the blood will be diſcharged as freely as if a languid circulation did exiſt.—3dly. The ſupple and flexible ſtate of the joints cannot be eſteemed a poſitive ſign of life, becauſe, in animals that are killed by lightning, and mephitic vapours, their joints always remain flexible.—4thly. The ſtate of the ſphincter ani is noticed in only a few caſes; but they directly deſtroy the validity of the remark: ſee the 51ſt and 411th Caſes, and that related at page 154 of the Reports of 1785.—5thly. The clear and tranſparent ſtate of the eye has already been ſaid to afford us no certain information. In caſe 162 we read, that although there were ſome faint ſigns of life, yet "the eyes had loſt their luſtre;" and in the 62d Caſe, "not only the pupil was largely dilated, but the eyes had entirely loſt their luſtre;" yet both theſe caſes recovered: and Mr. Church, with whom this idea firſt originated, has informed the Society, that in a caſe at which he aſſiſted, though without ſucceſs, the party being irrecoverably dead, he perceived the cornea perfectly clear and tranſparent.

Putrefaction has by every one, but particularly by thoſe who have attended to the ſubject, been deemed a poſitive and unequivocal ſign of abſolute death; and ſo moſt certainly it is, when far advanced: but in its incipient, early ſtate, even this is to be viewed with a doubtful, ſcrutinizing eye, and can only be admitted in a certain degree; for there are ſome diſeaſes, to which the living body is liable, that ſo nearly reſemble putrefaction, as I conceive may be eaſily confounded. I will only mention two—the confluent ſmall-pox, and the ſea ſcurvy. In the former, at the time when death uſually takes place, the lower part of the body, and the extremities, are generally occupied with petechiæ, livid and flattened eruptions, with black and blue vibices; and the head and ſuperior part is covered with a black, ſcaly incruſtation, which, while it prevents our forming an accurate opinion of the colour of the integuments, confines the juices in ſuch a manner, as to occaſion their running into the putrefactive fermentation, the effluvia of which affects the organs of ſmell with preciſely the ſame ſenſation as the fætor of putrid fleſh.

That animal humors, ſecreted from the ſurface of the body, actually putrefy, is well known, and we have juſt given an inſtance of it; and that the reſt of the ſecretions and excretions acquire a high degree of putridity is equally evident. Baron Van Swieten mentions an inſtance of a long retention of urine, which, when it was drawn off, was ſo extremely putrid, as to affect the ſurgeon with a ſlight peripneumony for ſeveral days. The ſame ſometimes happens in putrid fevers, at which time alſo the fæces are in a highly putrid ſtate. I remember attending a woman with a very large abſceſs, which was ſituated either between the peritonæum and abdominal muſcles, or in the cavity of the abdomen, and vented itſelf by the navel. The diſcharge was ſo extremely putrid, that the women about her were driven out of the room; and my probe was tinged to ſuch a degree, that it was ſeveral days before it recovered its uſual appearance. Many ſimilar inſtances have occurred in my practice, and many more may be found in the writers of obſervations. Now, as theſe ſecretions were made immediately from the blood, it ſhould ſeem that the blood itſelf muſt in ſome degree be in the ſame ſtate; and that it is ſo, in certain caſes, will admit of little doubt. Morton affirms, he was witneſs to the following circumſtance: "the blood of a woman in a malignant fever, when it was let out, ſtunk to ſuch a degree, that the ſurgeon who bled her, and others who ſtood near her, fainted away."

By taking a view of ſome of the moſt remarkable ſymptoms which occur in the laſt ſtage of the ſea ſcurvy, and by obſerving the appearances which preſent themſelves on diſſecting thoſe who die of that complaint, this opinion will be confirmed. Dr. Lind, who has written the moſt accurately on this ſubject, gives us the following information—That on examining the lips, or the caruncles of the eyes, where the blood-veſſels lie moſt expoſed, they appear of a greeniſh caſt—That the gums are exceſſively fungous, with an intolerable degree of ſtench* and putrefaction, and that they have a gangrenous aſpect—That they are ſubject to profuſe hæmorrhages from different parts of the body—The blood is thin, and black as ink; after ſtanding ſome time, it proved of a dark, muddy colour, the ſurface in many places of a greeniſh hue, without any regular ſeparation of its parts; and when it was kept ſtirring, as it ran out of the vein, its fibrous part had only the appearance of wool or hair floating in a muddy ſubſtance. The ſkin was found covered with black and livid ſpots, reſembling extravaſation under it; and ulcers affording a fœtid, ſanious gore, abounding with putrid fleſh, and ſurrounded with livid edges, were extremely liable to occur in various parts of the body.

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* Dr. Huxham, relating the caſe of a ſcorbutic patient, ſays, "he ſtunk ſo much before he died, that the laſt time I viſited him, I could ſcarce bear the ſtench of the chamber, though not a ſmall one."

It is a known fact, that lobſters, and ſome other ſhell fiſh, ſtink moſt horridly while they are alive.

In diſſected bodies, the blood in the veins was ſo entirely broken, that by cutting any conſiderable branch, you might empty the part to which it belonged: the muſcles were found ſtuffed with corrupted blood, and, upon handling, they fell to pieces; the ligaments of the joints were corroded and looſe; the epiphyſes were ſeparated from the bone; the cartilages of the ſternum were detached from the ribs; and even ſome of the bones were found rotten. The heart and lungs were putrid; the bowels were corrupted; and the ſpleen fell to pieces, as if compoſed of coagulated blood. Do not all theſe circumſtances make it manifeſt, that both the ſolids and fluids of our body may become putrid, and that in no inconſiderable degree, while we are actually alive?

The nature and phænomena of putrefaction have been but little examined into, and are conſequently very little underſtood. Indeed, an intimate acquaintance with that ſubject does not, for the preſent purpoſe, ſeem abſolutely neceſſary: all that is requiſite for us to be acquainted with is, that the moſt remarkable changes induced by it are, an alteration in its colour and ſmell; both of which are ſo peculiarly and ſtrongly marked, and ſo well known to (at leaſt) every medical man, as to render a deſcription of them unneceſſary. Whoever, therefore, will take the trouble of forming a compariſon between the putrefaction of dead animal ſubſtances, and ſome of the appearances in the diſeaſes juſt mentioned, cannot heſitate in allowing them to be preciſely the ſame: in no other manner does it appear poſſible to account for them; but in this way they can ſatisfactorily be explained. Even ſuppoſing, for one moment, that it may not be exactly the caſe, the appearances are, at any rate, ſo extremely ſimilar, that it would be imprudence in the higheſt degree to allow, that an incipient putrefaction is at all times, and under every circumſtance, an infallible ſign of death.

Upon the whole, then, from what has been advanced, it does not appear that any poſitive ſign of the abſolute extinction of life has hitherto been diſcovered.

That ſuch marks, however, do really exiſt, I entertain not the leaſt doubt, although I will not at this time take upon myſelf poſitively to aſſert it: but that we are in poſſeſſion of a teſt by which we may at all times, and with certainty, be able to judge of its preſence or abſence, I am as convinced as conviction can make me; and I perſuade myſelf, by attending to what I have to offer, the validity of my remark will be univerſally allowed.

Death may be diſtinguiſhed into two kinds or ſpecies—apparent, and abſolute. By apparent death, I mean a ſtoppage of the circulation, reſpiration, and action of the brain; the irritability, however, or that peculiar property of the muſcular fibres which enables them to contract on being irritated, ſtill remaining. By abſolute death, I would be underſtood to ſignify, not only a ceſſation of the vital, natural, and animal functions, but where the principle of irritability is alſo entirely deſtroyed.

By this definition it appears, that the only true diſtinction between life and death, is the irritability, or what has been called, the vital principle. If, then, there are any ſigns which indicate its total abſence, thoſe may be deemed certain ſigns of death: and the following I conceive to be ſome of thoſe marks, which will enable us to aſcertain that point.

I. It has long been remarked by Mr. Winſlow, M. de Haller, &c. that the pupils of the eye, which were very wide at the time of death, and continued ſo ſome hours, became narrower after a certain period. The ſame appearance have I obſerved in my attendance on drowned people; and for ſome time I conceived, the pupil being contracted would afford an unexceptionable indication of death. Dr. Whytt, however, relates two caſes, where the pupil being remarkably wide, and deſtitute of all motion for ſome time, became narrower, even a day or two before death, in two boys, who died of a dropſy in the ventricles of the brain. In theſe patients, the ſpt. ſalis ammon. held to the noſe, or a ſpoonful of cordial julep, made the pupil inſtantly as wide as it is obſerved in a confirmed gutta ſerena, but ſoon after it became narrower again. Theſe facts will prevent our acknowledging this article as a poſitive ſign in every inſtance: but as they are, to uſe the Doctor's own words, "remarkable hiſtories;" as I cannot find that the ſame circumſtance is noticed by any other writer; and as theſe children did not die a violent death; I am ſtill of opinion, that the pupil being contracted, eſpecially if it has been obſerved to be much dilated, will, in caſes of ſubmerſion, yield us pretty certain information.

II. There is another appearance of the eye, which I have not long, or often obſerved; but as I met with two caſes nearly at the ſame time, where this mark came on as ſoon as the ſymptom of life diſappeared, it made a particular impreſſion upon me, and I very much regret that I did not earlier attend to the ſubject, and thence might at this time have been enabled to ſpeak more deciſively upon it. What I allude to is, one of the pupils being more contracted than the other. I will not attempt to explain this appearance; but ſhall only obſerve, that the motion of the pupils, both in light and darkneſs, in health and diſeaſe *, at the time of death, and under almoſt

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* I recollect only one diſeaſe as an exception, and that is where the edge of the iris adheres to the capſula of the chryſtalline lens, conſequently its diameter can neither

almoſt every circumſtance, is very nearly the ſame in both eyes. That this ſympathetic action of the muſcular fibres of the iris is effected by the medium of the brain, will admit of no doubt: when therefore this regularity is infringed, that is, when the two pupils are unequally contracted, it is very preſumable, that the influence of the brain and nerves is entirely annihilated, and the vital or irritable principle utterly deſtroyed.

III. Vital heat.—Vital heat and irritability are ſo intimately connected, that it is highly probable, when the former is preſent, the latter will be ſo likewiſe: but yet there are ſome circumſtances attending this

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neither be contracted or dilated. But even "in a confirmed gutta ſerena, if the ſound eye is covered, the pupil of the diſeaſed eye remains in every degree of light immoveable, and of the ſame ſize; but if the ſound eye is expoſed to the ſun-beams, the pupil of the other, which ſhewed no motion before, will be evidently obſerved to contract."

this idea, which I cannot immediately reconcile: for inſtance, I have more than once perceived, on diſſection, a manifeſt degree of heat among the inteſtines in the pelvis, four-and-twenty hours after death, although the limbs became cold, and ſometimes rigid, ſoon after reſpiration had ceaſed. On looking over authors of anatomical collections, I find many ſimilar inſtances, ſome of longer continuance, notwithſtanding the weather was at the time very cold: and caſes have likewiſe not unfrequently happened, where even the external heat has continued near twenty hours after the perſon has died of a fever. Whether the irritability in theſe bodies continued as long as the heat, is now impoſſible to determine; but it is by no means improbable, becauſe the heat of all animal bodies juſt dead, would be reduced to the temperature of the ſurrounding medium in equal times with another animal of the ſame ſpecies and ſize, that was abſolutely dead, but heated artificially to the ſame degree. The heat therefore of that body which continues longer than uſual, muſt be ſupported by ſome internal animating or vital principle; and conſequently we may, at leaſt in caſes of drowning, eſtabliſh natural heat as a mark that irritability, or the vital principle, has not entirely quitted the corporeal frame.

Allowing animal heat and the living principle to be co-equal, it ſtill remains to mention the manner by which we may with certainty judge of their preſence or non-exiſtence. We know that the internal heat always remains a conſiderable time longer than the external; and we have ſeen above, that it ſometimes remains very many hours in the contents of the pelvis, after every evident external appearance of its exiſtence has quitted the body: a thermometer, therefore, commodiouſly conſtructed*, being introduced three or four inches into the rectum, will, by the quickſilver remaining ſtationary, or by its riſing or falling, readily indicate the preſence or poſitive extinction of life.

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* That deſcribed by Mr. Hunter, in his paper of "Experiments and Obſervations on Animals, with reſpect

IV. It was obſerved before, that no probable or ſatisfactory cauſe had been aſſigned for the uncertain occurrence of water in the lungs; and that it did not ſeem to have been thought, that it would be productive of any material advantage, if it were exactly aſcertained. To me, however, it appears very differently; as I am of opinion, if we attend properly to the ſubject, that we ſhall find it claims our particular notice, as it probably comprehends a circumſtance of the very firſt importance in the reſuſcitating art.

In conſidering the cauſes of death, we have endeavoured to prove, that immedi-

ſpect to the power of producing heat," will, on account of its moveable ſcale, prove very convenient for introducing into cavities.

ately on falling into the water, a violent contraction ſeizes the muſcles, which guard the aperture of the lungs ſo effectually as to prevent the entrance of water into the windpipe: in this ſtate of contraction do theſe parts continue, not merely till death, conſidered as a general circumſtance, effected by the ſuſpenſion of the vital powers, has taken place, but probably till the irritability of the muſcular fibres is deſtroyed. This principle remains a conſiderable time after the motion of the heart and lungs have ceaſed; but it does not continue ſo long in one perſon as in another; nor are all parts of the ſame body equally irritable.

Every one has, upon a thouſand occaſions, experienced the extreme irritability of the ſuperior part of the windpipe; and that during life it continues ſo, as long as any part of the body whatever, we have good reaſon to preſume, ſince we find that at the point of death, when the pulſe at the wriſt has ceaſed; reſpiration become interrupted; and even when the patient is inſenſible to almoſt every other ſtimulus; the ſmalleſt drop of liquid getting into the lungs, immediately raiſes the languid and oppreſſed powers of nature, and the thoracic and abdominal muſcles are excited by violent exertions to aſſiſt in expelling the intruding drop. And that the ſame power remains after death, even longer than in the heart, diaphragm, or inteſtines, is placed out of doubt, by one of the moſt powerful ſtimulants continuing to produce very conſiderable contractions about the former, when it had ceaſed to occaſion that effect in the latter.

When irritability in any part is totally deſtroyed, death may then, in the ſtrict ſenſe of the word, be ſaid to have taken place in that part, and a ſtate of relaxation immediately enſues. When, therefore, this principle has quitted the ſuperior part of the larynx (and, from what has been ſaid in the laſt paragraph, we ſhould not expect it would, till every other part was abandoned) its muſcular fibres, in which this power reſides, will ceaſe to act; hence the epiglottidii muſcles, whoſe office is to draw the epiglottis cloſe over the glottis, ſo as to ſhut completely the orifice of the trachea, loſe their action; the cartilage, by means of its elaſticity, is elevated, the paſſage into the windpipe becomes open, and now not the leaſt obſtruction exiſts to prevent the water getting into the lungs.

From this explanation it appears, that water never enters the lungs till the animal is in that ſtate from which a recovery cannot poſſibly be expected: and, if the principles on which my opinion is formed be juſt, this circumſtance is to be conſidered as a true criterion by which we may diſtinguiſh between apparent and abſolute death.

This idea, if not proved, is at leaſt certainly not contradicted, by any caſe on record; for not one inſtance has ever occurred of a recovery taking place, where water was even ſuſpected to be in the lungs: on the contrary, of the great number of ſucceſsful caſes with which the Reports of the Humane Society abound, where the people have been recovered after being under water from five to thirty minutes and upwards—a violent cough, the firſt ſymptom which muſt take place as ſoon as the action of the lungs is reſtored, if water is in the windpipe, has in no one inſtance been mentioned to have occurred at that time; and when it has happened, in the courſe of the recovery, it ſhould ſeem that it was only in a ſlight degree. With reſpect to the difficulty of breathing, and pain in the cheſt, which have ſometimes preſented themſelves, and are by many ſuppoſed to happen only when water gets into the lungs; they may, I preſume, with at leaſt equal propriety, be accounted for, by the great diſtention which the pulmonary veſſels have neceſſarily ſupported: from this expanſion they will recover with little inconvenience, provided thoſe parts are ſound and ſtrong; but if they have previouſly been occupied by any diſeaſe, they muſt afterwards of courſe ſuffer, according to the length of time the diſtention exiſted, and the nature and violence of the diſeaſe with which they were affected. Similar ſymptoms have occurred in thoſe ſtrangled by the cord, although their greateſt complaint is generally in their head: and why, therefore, when thoſe ſymptoms appear from drowning, may they not be attributed to the ſame cauſe?

In the courſe of the experiments I inſtituted, with a view of elucidating this circumſtance, I never once could perceive the appearance of the coloured liquor in the lungs of thoſe animals which had been only a ſhort time under water; but in thoſe that had been long in that ſituation, their lungs were always evidently filled. When the lungs were free, the irritability always remained; but when there was water in them, not the leaſt contraction could be excited in any part of the body. As a further preſumption, that the water does not enter the lungs till the animal is abſolutely dead, a kitten was drowned under a glaſs receiver, in a ſtrong decoction of logwood, and was kept there fifteen or twenty minutes after all motion had ceaſed; it was then removed from the coloured liquor into clear water, and remained there a conſiderable time: on opening it, the lungs were filled with water, but there was no appearance of the colouring matter; which is a convincing proof, that the water did not enter the windpipe for at leaſt a quarter of an hour after apparent death had taken place.

It is no eaſy matter to determine when water is in the lungs; for if they are entirely filled, a conſiderable quantity will be expelled on the firſt preſſure of the cheſt; but there is no method of diſcovering, whether it comes from the lungs or the ſtomach. If there is a ſmall quantity only, it occaſions, on inflating the lungs, a particular noiſe, ſimilar to what, in dying people, is called the rattling in the throat: but almoſt the ſame noiſe conſtantly occurs, for if there is really no water in the lungs, there is generally mucus, which will occaſion a ſimilar ſound. The only circumſtance which I apprehend can guide us in our opinion, is by attending particularly to the effect of artificial reſpiration. We are able to diſtinguiſh two, and I believe only two impediments, to the proper and effectual inflation of the lungs; one, from the glottis cloſing the aperture of the windpipe; the other, from water in the lungs. When the firſt cauſe exiſts, we are not able, merely by blowing into the mouth or noſtrils, to effect the leaſt motion of the cheſt, or to make a particle of air paſs into the lungs: and the greater force we exert, the leſs likely ſhall we be to ſucceed, till on raiſing the epiglottis we readily accompliſh our intention; whereas, when water is in the lungs, we can with great facility produce ſome motion in the cheſt, which ſhews the opening into the lungs is free; but neither that, or the quantity of air thrown in, is at all conſiderable, or anyways equal to what might be expected. This motion of the lungs, when it has been continued a ſhort time, always forces away a quantity of very frothy water; and as this is expelled, the lungs will admit a larger quantity of air, and the motion of the cheſt will become more perceptible. By attending properly to theſe appearances, we ſhall, I am perſuaded, be enabled, with readineſs and certainty, to decide whether the water has made its way into the windpipe.

Electricity has ſeveral times been applied in the recovery of the apparently dead; and although it has not always effected the purpoſe for which it was applied, it has, in every inſtance that is made public, proved its importance, and afforded ed the moſt ample and deciſive teſtimony of its wonderful and extenſive influence. A caſe which happened under my care early in the year 1785, made a ſtrong impreſſion on my mind, and prejudiced me much in its favour. A young man, after being a conſiderable time under water, was expoſed in his wet cloaths to the cold air for the ſpace of an hour before any means could be uſed to reſtore him—artificial reſpiration, warmth, the tobacco gliſter, volatiles thrown into the ſtomach, frictions, and various leſſer ſtimuli, were employed near an hour, without the leaſt benefit or alteration: electricity was then applied, and ſhocks ſent through in every poſſible direction; the muſcles through which the fluid paſſed were thrown into ſtrong contractions, nearly as violent as is uſually obſerved in healthy people: this extraordinary appearance recurred as often as the electricity was applied, for the ſpace of two hours, that is, four hours from the time he fell overboard, and, I have no doubt, from the time his pulſation and breathing ſtopped; after which period its effect ceaſed, and no alteration whatever could be produced. Since this accident, I have conſtantly had recourſe to the ſame agent in every ſimilar caſe: in general it has been attended with the ſame effects; but in one perſon, whom there was afterwards reaſon to believe had been ſome hours in the water, in intenſely cold weather, not the leaſt motion whatever could be effected.

" The electrical ſhock was tried on the body of James Lawſon, *four hours* after it was taken out of the water, every other method having been tried in vain. The firſt ſhock excited a pulſation in the temporal artery; the next diffuſed a florid colour over the face, and occaſioned the blood to flow in a copious ſtream, and to a conſiderable quantity, from an orifice which had been opened in the jugular vein, in the beginning of the proceſs, without a drop having iſſued from it. The ſubſequent ſhocks were attended with no manifeſt advantage, and every favourable ſymptom ſubſided." See Reports for 1775, p. 77.

My experiments upon animals coincide entirely with the above appearances. In no one inſtance did electricity fail in renewing the action of thoſe muſcles through which it was directed, for a conſiderable time after the vital actions had ceaſed: and when its effect was loſt, not the moſt gentle or the moſt powerful ſtimuli, neither oil of vitriol or the knife, nay, not even the actual cautery itſelf, could effect the moſt trifling alteration in the muſcular fibres.

From theſe conſiderations it appears to me, that the electrical ſhock is to be admitted as the teſt, or diſcriminating characteriſtic, of any remains of animal life; and ſo long as that produces contractions, may the perſon be ſaid to be in a recoverable ſtate; but when that effect has ceaſed, there can no doubt remain of the party being abſolutely and poſitively dead.

PROGNOSTIC.

FROM a conſideration of what has been delivered, reſpecting the tendency to apoplexy (from p. 65 to 69) and to diſeaſes of the heart and lungs (69, 70) by attentively obſerving the accidental circumſtances (70 to 75); the nature of the conſtitution (76 to 90) and the ſigns of life (110 to 126); I entertain no doubt but we ſhall be enabled to form our prognoſtic with tolerable accuracy and preciſion.

THE METHOD OF RECOVERY.

IN explaining the moſt effectual method of conducting this proceſs, it will be neceſſary to recal to our mind the ſtate of the vital organs, when life is ſuſpended by the ſtoppage of reſpiration, which we have ſhewn to be the cauſe of death in thoſe who periſh from ſubmerſion.

The blood, returning from all parts of the body, is collected in the right auricle and ventricle of the heart, from whence it ought to be propelled through the lungs; but their motion being ſtopped, only a ſmall quantity can paſs from the extremities of the pulmonary artery to the commencement of the pulmonary veins; hence the right auricle and ventricle, with the pulmonary artery, will be ſoon filled and over diſtended; in conſequence of this, the venæ cavæ will not be able to empty themſelves, and the blood will be accumulated throughout the whole venal ſyſtem, while the left auricle and ventricle, and the whole arterial ſyſtem, will be nearly deſtitute of blood: the jugular veins, therefore, and the ſinuſes of the dura mater, which immediately communicate with each other, cannot poſſibly expel their contents; and the ſame cauſe being extended to the veins of the brain, that part will, on account of the great quantity of blood ſent to it, and the fine, delicate, and tender conſtruction of its veſſels, be ſooner compreſſed: its functions and influence will therefore be ſuſpended or deſtroyed, and the patient will die apoplectic*.

From

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* I am ſenſible that, under particular circumſtances, beſides thoſe already mentioned, individuals may ſometimes ſuffer from ſuffocation or congeſtion about the heart and lungs, rather than from compreſſion, or an over-fulneſs of the veſſels of the brain: and where we are made acquainted with the previous ſtate of the conſtitution, we may, I think, be enabled, in a great

meaſure,

From our knowledge of theſe circumſtances, it becomes evident that two indications are particularly pointed out. The firſt—to remove the compreſſion of the brain, and the congeſtion about the heart and lungs. The ſecond—to excite the irritability of the muſcular fibres.

meaſure, to form a tolerably juſt opinion when that does occur; yet it would ſeem, that this diſtinction could not afford us any material advantage in practice, ſince, from the intimate connection of both conditions, the ſame remedies in general muſt be equally uſeful in either.

It is probable alſo, that from certain peculiarities in the conſtitution, and likewiſe from the operation of ſeveral of the accidental circumſtances mentioned at page 70 et ſeq. that a multiplicity of effects may take place in the ſyſtem, ſometimes ſingly, ſometimes variouſly combined; yet, as it does not appear poſſible for us, generally ſpeaking, to aſcertain, with any tolerable accuracy, what theſe effects really may be, I am inclined, from the perſuaſion that the circumſtance of the compreſſion of the brain by far more generally prevails than any other, upon all occaſions to pay moſt particular attention to it, eſpecially as in ſo doing, from the mutual connection of the whole, the reſt cannot be materially neglected.

I. The removal of the compreſſion of the brain, and the congeſtion about the heart and lungs, may be effected by, blood-letting—the imitation of natural reſpiration—and by proper poſition.

The propriety of having recourſe to early bleeding, is by no means univerſally allowed. The directions of the Society, although they do not poſitively forbid it, yet their ſtrong diſſuaſion amounts almoſt to a prohibition; and it is but juſtice to mention, that the opinions of ſome of the firſt authorities are deciſively againſt it. For my own part, although I do not think bleeding is always and in every caſe neceſſary, yet I conceive there are but few where it would be productive of miſchief, provided it be properly timed, and performed in the moſt eligible part: but where the external appearances, ſuch as the intenſe ſwelling and lividity of the face, the ſuffuſion and diſtention of the eyes, indicate violent oppreſſion of the brain, more eſpecially if they happen in plethoric habits, or where there is any diſeaſe, or tendency to diſeaſe, in the vital organs—there bleeding ought, in my opinion, by no means to be omitted.

When this operation is to be performed, it ſhould be had recourſe to immediately, before any ſymptoms of life have made their appearance; for when they are preſent, it is evident the compreſſion of the brain muſt be in ſome meaſure removed; and the event of the 3d, 10th, 144th, 247th, 260th, 421ſt, 467th, 485th, 487th, 498th, 499th, 595th Caſes, and that related at the 145th page of the Reports for 1785, juſtify this advice.

It is at this time, the firſt appearance of life, that we ſhould be particularly attentive not to interfere with nature too much in any reſpect, more eſpecially not to diſturb her ſalutary actions by any operation which may tend to ſink the vires vitæ, or depreſs the already languid circulation. For this reaſon, I cannot avoid conſidering the employment of blood-letting, at this critical time, as of doubtful effect; yet we meet with very many caſes where blood has under theſe circumſtances been taken away, and in ſeveral inſtances it manifeſtly increaſed the ſymptoms of life. In the 6th Caſe, it is ſaid, "I diſcovered a ſpaſm or two about his eyes: I then proceeded to venæſection; immediately the ſpaſms increaſed, and were ſucceeded by diſtortions of the body and limbs." In the 7th, as ſoon as the pulſe was to be felt, I took away eight ounces of blood; ſoon after he was made to ſwallow. In the 21ſt, as ſoon as a trifling pulſation was diſcovered, a vein was opened; he then ſighed, &c. In the 71ſt, the pulſe being increaſed, I took away ſome blood, which ſeemed to have a very good effect. In the 80th, as ſoon as the pulſe was perceived, a vein was opened, and the blood flowed very freely; juſt at that inſtant ſhe fetched a deep ſigh, and began to have ſome motion. In the 362d, as ſoon as a very weak pulſe was perceived, ſome blood was taken from the arm; and I could afterwards find the pulſe and ſpaſms get ſtronger. In the 400th, when he was able to ſpeak, I took away five ounces of blood: the good effects of bleeding were very conſpicuous. In the 421ſt, three ounces were taken away before any ſymptom of life, and ſix ounces on the firſt appearance of it. In the 96th Caſe, the patient was blooded three times, although the pulſe was weak and fluttering, the heat much leſs than natural, and the eye ſet and glaſſy: on his loſing blood the third time, the pulſe grew full and regular, the heat increaſed, whilſt the ſpaſms and difficulty of breathing leſſened. In the 302d, the man was much convulſed; ten ounces of blood were taken from his arm, after which he ſeemed to revive much. In the 236th, I took about five ounces of blood, which relieved him greatly, and ſeemed to contribute much to his more ſpeedy recovery.

The ſame practice was purſued in the 69th, 164th, 235th, 264th, 308th, 323d, 474th, 524th, 596th, 2d, 19th, 51ſt, 52d, 94th, 103d, 109th, 138th, 139th, 163d, 164th, 277th, 238th, 289th, 299th, 308th, 364th, 374th, 383d, 385th, 392d, and 398th Caſes, and likewiſe in the 155th, 176th, and 177th pages of the Reports for 1785—all the caſes wherein bleeding at this time is mentioned: they all terminated in the moſt favourable manner, and without the leaſt apparent inconvenience from the loſs of blood. Now, if blood may be taken away with advantage when the feeble powers of the conſtitution are juſt beginning to exert themſelves, and when the compreſſion of the brain is leſſened; with how much greater probability of ſucceſs may it be uſed, when the compreſſion is complete, and before the veſſels of that organ are at all unloaded?

Before our patient is perfectly recovered, but after the circulation is in a great degree eſtabliſhed, we ſhall frequently be called upon to relieve various ſymptoms which ariſe from congeſtion, either in the head or thorax; ſuch as, pain and heavineſs in the head, ſtupidity, coma, delirium, difficulty in breathing, pain in the breaſt, &c. &c. Whatever objection may be urged againſt bleeding in the early ſtage of theſe accidents, no one will, I believe, oppoſe it in this; for it is certain no remedy can anſwer ſo ſpeedily and effectually; and it may require to be frequently repeated before the effect is produced.

The part from whence the blood is to be drawn, is in theſe caſes by no means a matter of indifference. If it is taken from the arm, the diſtention of the brain, for which principally this operation is performed, will ſcarcely be at all leſſened on account of the ſtagnation of the blood, and the diſtance from the part affected; added to which, blood can ſeldom be procured in ſufficient quantity from this part. If the temporal artery is opened, no benefit will ariſe, becauſe we have already ſhewn, that the veins only are overloaded, and that the arteries are almoſt deſtitute of blood: but the external jugular veins, although they bring the blood from the external part of the head only, yet as they immediately communicate with the ſuperior venæ cavæ and internal jugulars, which receive the blood from the ſinuſes of the dura mater and veins of the brain, certainly ought to be preferred on theſe occaſions.

The application of cupping-glaſſes to the head, neck, and breaſt, may be extremely ſerviceable, particularly if we cannot procure a ſufficient quantity of blood from the jugular veins. This mode of operating, independant of the evacuation, will be attended with the additional advantage of proving a powerful ſtimulus.

It is, however, to be obſerved, that large and repeated bleedings do not ſeem ſo indiſpenſably neceſſary in the preſent inſtance, as in apoplexies ariſing from ſome other cauſes, as artificial reſpiration will in general anſwer the purpoſe of removing the over-diſtention of the venal ſyſtem, conſequently the compreſſion of the brain, nearly as effectually and expeditiouſly; and is not liable to be attended with any diſadvantages. In a full inſpiration, the veſicles of the lungs are expanded, and at the ſame time the capacity of the pulmonary blood-veſſels is conſiderably increaſed, ſo as to receive a larger quantity of blood from the right ventricle. In expiration, the veſicles are collapſed, and the contents of the blood-veſſels are, in conſequence, driven into the left auricle and ventricle. This proceſs, frequently repeated, will in a ſhort time remove the congeſtion in the great veſſels; and the compreſſion of the brain, which depended upon that congeſtion, will, I conceive, be as readily overcome as by opening a vein.

On this account, and particularly as it is removing the cauſe of death, we cannot heſitate one moment in pronouncing, the reſtoring the action of the lungs to be of the very firſt importance in all our attempts to recover the apparently dead. Dr. Fothergill, with great propriety, compares the lungs of drowned people to a clock whoſe pendulum is ſtopped; yet, ſays he, renew but the action of the lungs in the one, and touch but the pendulum in the other, and all again is life and motion. The ſame gentleman obſerves, in another place, that to inflate the lungs, eſpecially of drowned perſons, completely, requires no inconſiderable ſhare of ſkill and dexterity.

To effect this intention, the orders of the Society direct an aſſiſtant to blow into the mouth through a coarſe cloth, or to introduce the nozzle of a pair of bellows either into the noſtril or mouth. The blowing into the mouth may, upon an emergency, anſwer for a few times; but the difficulty of getting people to continue it will be eaſily conceived, on account of the operation being ſo extremely diſagreeable and troubleſome. The inflating the lungs, by introducing the nozzle of the bellows into the mouth, is very unhandy and difficult; and it will ſeldom prove more convenient when it is puſhed into the noſtril.

To remedy theſe inconveniences, ſeveral contrivances have been formed. "A wooden pipe, fitted at one extremity for filling the noſtril, and at the other for being blown into by a perſon's mouth, or for receiving the pipe of a pair of bellows," is recommended by Drs. Monro and Cullen. Mr. Hunter adviſes "a pair of bellows ſo contrived, with two ſeparate cavities, that by expanding them, when applied to the noſtrils or mouth of a patient, one cavity may be filled with the common air, and the other with air ſucked out of the lungs; and by ſhutting them again, the common air may be thrown into the lungs, and that which is ſucked out of the lungs be diſcharged into the room. The pipe of theſe ſhould be flexible, in length a foot or a foot and a half, and at leaſt three-eighths of an inch in width: by this the artificial breathing may be continued, while the other operations, except the application of the ſtimuli to the ſtomach, are going on, which cannot conveniently be done if the muzzle of the bellows be introduced into the noſe." Mr. Savigny's is, "an elaſtic tube, about twelve inches in length, to one end of which is fixed a piece of ivory, ſo conſtructed, that it may be blown through either by the mouth, or a pair of bellows adjuſted to it; and to the other end, an addition of ivory alſo, of ſuch a form as to enter and fill up a noſtril." Mr. Sherwen's is, "a curved inflater with a double nozzle, which may be adapted in two minutes to any pair of bellows, or to any pair of noſtrils in the kingdom."

Each of theſe inſtruments will anſwer the purpoſe of inflating the lungs very effectually;

fectually; but the firſt is inconvenient, on account of its interfering with, and in a great meaſure preventing, the application of the other remedies; a diſadvantage which neither of the others are liable to, becauſe the inflation is managed by a perſon ſtationed at the head of the body, and out of the way of the other aſſiſtants.

That invented by Mr. Hunter is certainly the moſt complete of theſe inſtruments; but it may be doubted whether it ſhould in general be preferred to the others, which are more portable and ſimple, and leſs expenſive, becauſe a ſecond aſſiſtant will, in both caſes, be neceſſary to keep the pipe in the noſtrils, the mouth ſhut, and a proper preſſure on the cricoid cartilage: and the ſucking the air out of the lungs does not appear any very material advantage, as the thorax will naturally contract when the mouth is opened; and if it does not ſufficiently, a gentle compreſſion will effectually anſwer that purpoſe.

The difference between the elaſtic tube and the curved inflater ſeems immaterial: the former I have made ſeveral experiments with; and every inſtance in which I tried it, anſwered completely: the latter will, no doubt, ſucceed equally well; but the nozzles do not appear particularly calculated to ſuit every pair of noſtrils, or the pipe adapted to fit every pair of bellows.

No particular directions are given for the uſe either of Dr. Cullen's or Mr. Hunter's inſtruments; but as, from my own want of ſucceſs, I conclude every one elſe, at leaſt on their firſt trial, have not perfectly ſucceeded in imitating natural breathing, it may not be improper to mention the directions which are given with the two laſt. In uſing the elaſtic tube, it is adviſed, " that a proper perſon, ſtationed at the head of the body to be operated upon, paſſes the appropriated end of this tube into one of the noſtrils; and ſuſtaining it there with the forefinger, he compreſſes both noſtrils ſo firmly between the thumb and middle finger of the ſame hand, that no air can paſs otherwiſe than by the tube; and the other hand applying the other end of the tube to his mouth, he blows with force through the pipe, into the noſtril of the ſubject. The medical director ſtanding at the right hand of his charge, muſt keep the mouth perfectly cloſed with his left hand, while with his right, making a ſuitable preſſure on the prominent part of the windpipe, he prevents the air paſſing into the ſtomach; till, finding the lungs are properly diſtended, he is to preſs ſtrongly on the cheſt, removing, at the ſame time, the hand from the mouth, ſo as to let the air paſs out: when, by theſe means, the lungs are compreſſed, the ſame proceſs is immediately to be repeated, that, as far as can be, the manner of natural reſpiration may be imitated."

Mr. Sherwen propoſes, "that the patient ſhould be laid on a bed, with his head towards the foot it, and the curved inflater being applied, the medical aſſiſtant may ſit at his eaſe, and take upon himſelf the whole of the buſineſs, both of inflating and compreſſing the lungs, without interfering with the reſt of the aſſiſtants." Mr. Sherwen, however, does not ſeem to be aware, that it is one perſon's entire buſineſs to work the bellows; that another muſt be employed in making the occaſional preſſure on the breaſt and cricoid cartilage, and in keeping the mouth ſhut; and, beſide theſe, it will be neceſſary for ſome one elſe to retain the pipe in the noſtrils: ſo that, upon the whole, it does not appear, either that this inſtrument is peculiarly accommodated "to any pair of noſtrils, or any pair of bellows," or that "the ſurgeon can take upon himſelf the whole of the buſineſs, both of inflating and compreſſing the lungs;" or that he muſt not "interfere with the other aſſiſtants."

If any difficulty ſhould ariſe in diſtending the lungs, it muſt proceed either from water in the windpipe, or a contraction or adheſion of the epiglottis. We have already pointed out the method of diſcovering when the firſt circumſtance occurs; and when the latter is the caſe, we ſhall generally remedy the inconvenience by bringing the tongue forwards, which, being connected to the epiglottis by inelaſtic ligaments, muſt of courſe be elevated. Should any further impediment however occur, the crooked tube, bent like a male catheter, recommended by Dr. Monro, and mentioned by Mr. Portal, Mr. le Cat, and others, ſhould be introduced into the glottis, through the mouth or one noſtril; the end ſhould be connected to a blow-pipe, or, what will be more convenient, the pipe for the noſe belonging to the elaſtic tube may be removed, and this inſtrument ſcrewed in its place, according to the plan mentioned in the deſcription of a pocket caſe of inſtruments for the recovery of the apparently dead, by Mr. Savigny.

When every attempt to inflate the lungs has been made in vain, tracheotomy is our laſt expedient, and ought to be performed as ſoon as it becomes neceſſary. I acknowledge, however, I ſhould not expect it would ſucceed when the other means have failed: but, as I have not had occaſion to perform it more than once, I cannot ſpeak deciſively on the ſubject; it muſt be left, therefore, to be aſcertained by future experience. In the caſe alluded to, the lungs could not be inflated by the means recommended by the Society; and, no tubes being at hand, I made an opening into the trachea, in which was introduced a common diſſecting blow-pipe; but, after all, I was not able to produce the leaſt motion of the cheſt. This was occaſioned by the want of proper inſtruments; and it is probable the crooked pipe, ſcrewed on the elaſtic tube, would effectually anſwer on ſimilar occaſions.

Even where there was no impediment to inflating the lungs, the operation of tracheotomy has by many, but particularly by Dethardengius, been recommended when other means have failed, that the warm air might be more conveniently applied, and the water in the lungs more effectually evacuated. In the firſt caſe, the warm air may be as readily and commodiouſly applied by the noſtrils: and abundant experiments prove, that when water enters the lungs, it is not to be diſcharged either by that or any other means at preſent known.

Air loaded with the vapour of tobacco—of the volatile alkali—of the ſpirit of ſea ſalt—and ſpirit of ſulphur, have been recommended with the view of exciting the action of the lungs with greater expedition: the firſt, probably, from obſerving the violent exertions which were produced when, in ſmoking, a particle penetrated beyond the rimula glottidis; the ſecond was introduced by the chymiſts, in caſes of ſuffocation from mephitic air, under the idea that it would neutraliſe the noxious principle, which they conceived to be acid. In caſes of drowning, however, it appears to be recommended, as well as the two laſt, merely as a ſtimulant. This practice I conſider not only as of doubtful effect, but in general extremely hazardous, and replete with danger. In the beginning, and when we are called in ſoon after the immerſion, they ought to be ſtrictly prohibited; and if they are to be uſed at any time, I am of opinion with Mr. Hunter, it ſhould be "when a conſiderable time, ſuch as an hour, has been loſt," before aſſiſtance is procured; and I ſhould prefer, with him, the uſe of "the vapour of volatile alkali mixed with air; which may eaſily be done, by holding ſpirits of hartſhorn in a cup under the receiver of the bellows."

With fairer proſpect of ſucceſs, is the dephlogiſticated air of Dr. Prieſtley recommended for the ſame purpoſe. Dr.

Fothergill, in particular, has diſtinguiſhed himſelf by his truly ingenious remarks on its application to the ſubject now under our conſideration. It muſt be obſerved, however, that in this inſtance the Doctor's practice ſeems entirely influenced by a theory, which ſuppoſes the cauſe of death, in drowned people, to be noxious air ſtagnant in the cells of the windpipe: and as this ſpecies of air neutraliſes mephitic air, and renders it reſpirable, "it ſeems," ſays the Doctor, "to be the direct antidote ſupplied by nature for correcting the contaminated air ſtagnant in the bronchial cells, and alſo for inflating the lungs, in preference to common air."

When treating on the ſuppoſed cauſes of death, this theory received, what it in an eminent degree merits, a full and candid inveſtigation; but the reader will remember, that the ſum and concluſion of the arguments and experiments was, that "the death of animals cannot be attributed to the action of phlogiſton on the nerves of the lungs." If therefore this deduction be true, it does not immediately appear why dephlogiſticated air ſhould be uſed for the purpoſe of inflating the lungs, in preference to common air.

The ſame practice is mentioned by Mr. Hunter, Dr. Stokes, and Mr. Achard: the latter relates his having recovered various ſmaller animals, by removing them into veſſels of dephlogiſticated air, after being expoſed ſo long to the different kinds of noxious air, as to bring on the appearance of death. In theſe experiments, the common air was found unequal to the recovery; but the pure air, eſpecially when it was conveyed into the lungs, and when the animal was not continued in the foul air longer than a minute after reſpiration ceaſed, very generally anſwered. If animals ſuffocated in noxious air, actually draw it into their lungs, which we ſhall find in another place to be extremely probable, the application of pure air may then, agreeable to the idea of Dr. Fothergill, ſaturate and correct the incloſed contaminated air, ſo as to render it harmleſs and inoffenſive. But, as I cannot find any deciſive experiments have been made with this fluid on drowned animals, I muſt acknowledge, that after all that has been ſo ably and judiciouſly urged in its ſupport, it appears to me as of little conſequence, or at leaſt as a ſecondary conſideration, whether the lungs are inflated with dephlogiſticated or atmoſpheric air, or whether the air be blown from the lungs of a healthy perſon: it is their expanſion and contraction we are to endeavour to promote, in order to force the blood from the right to the left ventricle of the heart; and if that can be properly effected, it will, for obvious reaſons, be the moſt probable means of reproducing the circulation.

I would not wiſh, however, to be underſtood as having any objections to the uſe of this air, further than the difficulty in procuring a ſufficient quantity in a pure ſtate—the want of an eaſy method of adminiſtering it—and its rendering the apparatus more complicated and incommodious: on the contrary, if thoſe inconveniences can be overcome, I think it well worth our trial. All I would aim at is, to obviate our placing too much confidence in it, and by that means retarding or preventing the employment of other remedies, whoſe application might prove of conſiderable importance *.

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* The quantity of dephlogiſticated air neceſſary for producing artificial reſpiration, even a ſhort time, and the expence attending it, are much greater, probably, than may at firſt be apprehended. In this operation, I conceive it requiſite to produce as much motion in the lungs as they will allow of; which, indeed, is imitating the manner nature compels us to act in, when, for a ſhort time, we forcibly retain our breath, for we are then obliged to make ſeveral full inſpirations, in order to propel the blood, which abounded in the right ventricle and pulmonary artery, into the pulmonary vein. From repeated experiments, I have found my lungs, when completely diſtended, to contain 300 cubic inches of air; and if we allow for what is

It is cuſtomary, in attempting recovery, to lay the body perfectly horizontal; but it will certainly prove much more efficacious, if the head and cheſt be raiſed ſo as to form an angle of about twenty degrees, which

is in the mouth, fauces, and cavity of the noſe, and for a ſmall waſte, I think we cannot, with any propriety, eſtimate each inflation at leſs than 300 cubic inches: and if ten of theſe inflations are made in a minute, and the operation continued only ten minutes, both which are moderate calculations, 30,000 cubic inches will be expended. This would very nearly occupy the ſpace of two hogſheads. The inconveniences and difficulties attending the collection of ſuch a large quantity immediately, is not readily conceived, except by thoſe who are in the habit of preparing artificial airs: and the expence attending it will be by no means inconſiderable, even if it is expelled from nitre, which is the cheapeſt method; but if the air is procured from red lead, and the nitrous or vitriolic acid, the quantity which can be obtained from theſe materials is ſo very ſmall, that the charge would be enormous. The coſtlineſs of the article, however, is the moſt trifling objection which can be brought againſt it, and could not require one moment's conſideration, was it found to anſwer, and could it be readily procured and conveniently adminiſtered.

indeed is as high as it will allow of without ſlipping. This poſition, it is evident, will aſſiſt materially in diffuſing the ſtagnant blood, and in relieving the congeſtion of the vital organs.

II. The exciting the irritability of the muſcular fibres may be done, 1ſt, by general ſtimulants, or thoſe which affect the whole ſyſtem; 2dly, by local ſtimulants, or thoſe which are applied to irritable parts.

The general ſtimulants are—heat—electricity—and frictions. The local ſtimulants are—aromatic and irritating medicines injected into the ſtomach and bowels — and particular ſtimuli, adapted to the different organs of ſenſe.

GENERAL STIMULANTS.

1ſt. HEAT.—We know, from an infinite number of circumſtances, that heat is indiſpenſably neceſſary for our exiſtence; we are taught by experience, that the difficulty of recovering drowned people is, in moſt inſtances, equal to the deficient degrees of heat; and it is known by all, that the natural heat of bodies and vitality are ſo nearly connected, that it is certain they never can be ſeparated, nor co-exiſt but within certain degrees of reciprocal proportion. From all theſe conſiderations it is preſumable, that by prudently ſupporting and increaſing the heat which remains in the body, we may at the ſame time augment the vital principle. The judicious and effectual application of artificial heat, therefore, requires our earlieſt attention.

Of all the different modes of applying this principle, that of covering the patient with warm grains, appears to me the moſt powerful; and immerſing the body into warm water the next. Grains, or warm water, may very generally be procured, as the large quantities uſually kept in breweries or diſtilleries will retain their heat many days. The uſe of either of theſe, however, will be attended with ſo many inconveniences, and muſt inevitably interfere ſo much with the application of other means, that I am of opinion they ſhould be given up in favour of a mattraſs covered with a blanket, and placed at a proper diſtance before a large fire. The body, as was before mentioned, ſhould be raiſed ſo as to form an angle of about twenty degrees; and the ſituation ſhould be varied, ſo that every part may receive a due proportion of heat.

The natural warmth of a healthy perſon, and warm ſubſtances, as bricks, bottles of water, &c. &c. have been recommended. The firſt is liable to the ſame objections as the bath and grains; and the laſt, by interfering with the frictions, will be found troubleſome and inconvenient.

In the application of heat, I would wiſh particularly to impreſs the mind with the idea of the abſolute neceſſity of its being at firſt employed in the moſt gentle manner, and that it ſhould be increaſed very gradually; otherwiſe, inſtead of being one of the moſt effectual remedies, it may certainly prove the moſt deſtructive; as the ſudden application of heat, in any higher than certain appropriated degrees, may produce ſuch violent and diſproportionate expanſion, or action of the contiguous parts, or ſuch changes in the arrangement and compoſition of the conſtituent principles of the reſpective humors or ſolids, to which that heat has acceſs, as to ſeparate thoſe humors or parts from, or render them no longer fit for, the purpoſes of the animated ſyſtem, as happens in the ſudden thawing of ſtones, which are thereby crumbled and burſt; of fleſh and vegetables, whoſe texture is entirely deſtroyed; or of liquors, which become thereby vapid and uſeleſs.

" From obſervations and experiments," ſays Mr. Hunter, " it appears to be a law of nature in animal bodies, that the degree of external heat ſhould bear a proportion to the quantity of life; as it is weakened, this proportion requires great accuracy in the adjuſtment, while greater powers of life allow it greater latitudes.

" If an eel is expoſed to a degree of cold ſufficient to benumb it, till the remains of life are ſcarcely perceptible, and ſtill retained in a cold of about 40°, this ſmall proportion of living principle will continue for a conſiderable time, without diminution or increaſe; but if the animal is afterwards placed in a heat of about 60°, after ſhewing ſtrong ſigns of life, it will die in a few minutes*.

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* It appears that caſes not unfrequently occur, of perſons who ſeem almoſt perfectly recovered, dying very ſuddenly: no cauſe has been aſſigned for this unexpected

"I obſerved, many years ago, in ſome of the colder parts of this iſland, that when intenſe cold had forced blackbirds or thruſhes to take ſhelter in outhouſes, any of them that had been caught, and from an ill-judged compaſſion expoſed to a conſiderable degree of warmth, died very ſoon. The reaſon of this I did not then underſtand; but I am now ſatisfied, that it was owing, as in other inſtances, to the degree of heat being increaſed too ſuddenly for the proportion of life remaining in the animal. From theſe facts it appears, that warmth cauſes a greater exertion of the living powers than cold, and that an animal in a weakly ſtate may be obliged to exert a quantity of the action of life, ſufficient to deſtroy the powers themſelves."

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expected circumſtance; but, from the effects of the precipitate application of too intenſe heat, here related, it ſhould ſeem extremely probable, in many inſtances, to be owing to that cauſe.

Theſe very ingenious and judicious obſervations make it evident, that no ſtandard can be fixed upon for the degree of heat, but it muſt be regulated entirely by the external warmth of the body. The applications ought in no inſtance, at the beginning, to exceed that warmth more than three or four degrees; and the ſame nicety is requiſite in the increaſe of it, as in its firſt application: hence we ſhall ſometimes be obliged to make uſe of ſo low a degree of heat, that it may at firſt ſight appear not only ineffectual and uſeleſs, but even calculated to ſink and depreſs the ſmall remains of life; but if we recollect the numerous and unequivocal inſtances of the beneficial effects of frictions of ſnow on parts that are frozen, and the conſequences that attend plunging the hand, when benumbed with cold, into cold water; if we conſider the deſtruction of the part in the one inſtance, and the intenſe pain in the other, which immediately follows on precipitately applying them to the fire; we ſhall inſtantly conceive the propriety, and indeed the abſolute neceſſity, of ſuch caution.

Animal bodies are found to freeze at about the 25°: in thoſe caſes therefore, where the body or extremities are found to be frozen, frictions of ſnow, or the coldeſt water, which are at leaſt 7° warmer than the part to which they are applied, ſhould be had recourſe to, and their uſe ſhould be perſevered in, till we preſume the icy particles are diſſolved or extracted, when artificial heat may, if there be occaſion for it, be applied in the manner, and under the regulations above mentioned. In other reſpects, the proceſs is to be the ſame as in caſes of ſuſpended animation, where the parts have not been in a frozen ſtate.

It ſometimes happens that the body, after it has lain in or under water from fifteen to twenty minutes or upwards, has required the ſame length of time to bring it on ſhore: during this period, the unfortunate wretch is in his wet cloaths, and (as theſe accidents are, for obvious reaſons, more frequent in the winter than in any other ſeaſon) he is probably expoſed to a cold, bleak wind, in froſty weather, without any covering to ſhelter him: when removed to a proper place, and ſtripped, his body conveys a ſenſation to the touch ſimilar to the coldeſt marble, though his limbs may not be rigid. Whether theſe bodies are always in a ſtate of congelation, we cannot always be certain; but if the body is found to be colder than the 32°, no doubt can then remain of the propriety of uſing the ſame method as if the body was abſolutely frozen.

Several hiſtories are related of bodies frozen being recovered; but we have reaſon to think they were not actually in that ſtate, ſince Mr. Hunter was not able to freeze either fiſh, dormice, ſnails, leeches, or earthworms, till they were deprived of life; nor could he, upon thawing them, although it was done in the moſt gradual manner, ſucceed in the recovery of one:

he was more fortunate, however, in his experiments on freezing the ears of rabbits, the combs and wattles of cocks, and the tails of tench; but on repeating the experiment on the tails of goldfiſh, it did not properly anſwer, for although they appeared for ſome days to be very well, yet in about a month it was evidently the cauſe of their death.

2dly. Electricity.—Soon after the inſtitution of the Humane Society in this kingdom, electricity was recommended by Dr. A. Fothergill and Mr. Henly, in caſes of apparent death: and it is matter of aſtoniſhment, and much to be regretted, that it has ſo ſeldom been employed in the recovery of thoſe who have ſuffered from drowning and other cauſes, as there is certainly the faireſt proſpect of its being attended with the moſt happy and ſucceſsful event. "Inſtead of loſing time," ſays Dr. Fothergill, "in the application of ſeveral ſlight ſtimuli to the ſkin and inteſtines,

teſtines, why not have recourſe to the moſt potent ſtimulus in nature, which can inſtantly pervade the inmoſt receſſes of the animal frame? why not immediately apply electrical ſhocks to the brain and heart, the grand ſources of motion and ſenſation, the primum vivens, and ultimum moriens, of the animal machine?"

About the ſame time a child, "aged three years, fell out of a one pair of ſtairs window, upon the paved ſtones. She was taken up to all appearance dead. An apothecary being ſent for, he declared that nothing could be done for the child. Mr. Squires, who lives oppoſite to the place where the accident happened, finding the caſe hopeleſs, with the conſent of the parents, very humanely tried the effects of electricity. Twenty minutes had at leaſt elapſed before he could apply the ſhock, which he gave to various parts of the body, without any apparent ſucceſs; but at length, on tranſmitting a few ſhocks through the thorax, he perceived a ſmall pulſation: ſoon after the child began to ſigh, and to breathe, though with great difficulty. In about ten minutes ſhe vomited. A kind of ſtupor remained for ſome days; but the child was reſtored to perfect health and ſpirits in about a week."

In addition to theſe, let me refer the reader to what has been already ſaid on the ſame ſubject, in the account of James Lawſon, and likewiſe in the caſe attended by myſelf (page 123); in both which inſtances, ſtrong appearances of life were excited, four hours after every other means had failed.

Theſe accounts eſtabliſh facts of a very important and intereſting nature. Do not they prove, clearly and indubitably, that animation is capable of being ſuſpended longer than we are aware of? Do they not plainly point out, that electricity is the moſt powerful ſtimulus we can apply? Is not the ſuperior advantages of this ſtimulus evinced in the moſt incontrovertible and unequivocal manner? And are we not juſtified in preſuming, that if it is able ſo powerfully to excite the action of the external muſcles, that it will be capable of reproducing the motion of the heart, which is infinitely more irritable, and by that means accompliſh our great deſideratum, the renewal of the circulation?

The part which, in my experiments on drowned animals, I found to be the moſt readily excited to action, was the diaphragm; and although the ſhocks were directed ſo as to paſs through the auricles of the heart, conſequently much above that muſcle, yet it was always brought into great contractions: and the part which retained its irritability the longeſt, I found to be, in ſeveral inſtances, the muſcles ſituated about the glottis. The periſtaltic motion of the inteſtines ſeemed to be little affected by electricity, either as to increaſing it, or reproducing it when it had ceaſed: and the only perceptible effect that attended paſſing ſhocks through the cerebrum or cerebellum, was ſtrong contractions of the muſcles through or near which the fluid paſſed: though I have ſometimes thought the contractions of the muſcular ſyſtem, in general, were more vivid and lively after the brain and ſpinal marrow had been electrified, than they were before.

The ſame attention and caution will be requiſite in the adminiſtering this powerful agent, as in the application of heat; for in the ſame experiments I always found, that when violent ſhocks were had recourſe to, their effects very ſoon ceaſed; and, on the contrary, when they were gentle, the actions were ſufficiently great, and might be continued a conſiderable time.

From the known property of ſimple electrification, in promoting the motion of fluids in capillary tubes, increaſing the circulation, and the inſenſible perſpiration in living animals, it ſeems well adapted for the preſent purpoſe; but I have frequently tried it on animals without the leaſt ſenſible effect. Moderate ſparks ſcarcely produced any motion; and even the moſt pungent were vaſtly inferior in their effects to the ſlighteſt ſhocks. Indeed, the ſame objections which were urged againſt the uſe either of warm grains or the warm bath, are likewiſe applicable to this article, only in a much greater degree; for while the body is inſulated, every other operation, the application of heat only excepted, muſt be entirely ſuſpended; a circumſtance we ſhould ſtudiouſly avoid, as the delay of a few minutes at this time, or the employment of an ineffectual remedy, may be productive of irreparable conſequences.

From theſe remarks we may gather, that electricity ſhould neither be employed ſo gently as to produce no effect, or ſo violently as to cauſe miſchief. Inſtead, therefore, of uſing ſimple electrification and drawing ſparks, on the one hand; or employing ſuch violent ſhocks as were recommended by Mr. Henly, on the other; it will be more prudent, at leaſt in the commencement of our operations, to apply ſhocks of not more than one third or half an inch, from a vial containing about twenty-four inches of coated ſurface. Theſe ſhould be tranſmitted through every part of the body, but more particularly through the diaphragm and intercoſtal muſcles; the heart, the brain, and the ſpinal marrow.

3dly. Frictions.—Theſe act as a ſtimulus in two ways; by producing motion of the blood in the vaſcular ſyſtem, and by irritating the nerves of the ſkin.

M. de Haller obſerves, that the heart is much more affected, in animals dying, or newly dead, by the gentle ſtimulus of warm water, or air puſhed into its ventricles, than by the moſt acrid liquors applied to its external ſurface, or even pricking it with the point of a knife: now the blood, being the beſt natural ſtimulus for exciting the motion of the heart, will of courſe act ſooner, and more powerfully, than either air or water; if therefore we can by any means propel it into the cavity of the heart, it will prove more efficacious than the moſt acrid application to its external ſurface. That frictions will have this effect, there can be no doubt; for if the veſſels are alternately compreſſed and relaxed, we in ſome meaſure ſupply the place of their natural motion, and their contents muſt of neceſſity be driven towards the heart, as the valves prevent its retrograde motion. Hence, in living ſubjects, by accelerating the motion of the blood, the action of the heart and arteries will be quickened; and if the frictions are violent and long continued, they will be increaſed ſo as to occaſion a ſmart fever, even in thoſe who are affected with dropſical complaints.

Dr. Whytt, in his Enquiry into the Motion of the Fluids in the ſmall Veſſels, has ſhewn how inconſiderable the effects of the projectile force of the heart muſt be in thoſe veſſels; and he has made it appear, that their vibratory motion is the principal cauſe of promoting the circulation of their fluids. "If," ſays he, "the motion of the fluids in the inferior order of veſſels be not ſo much owing to the force of the heart and larger arteries, as to the gentle alternate contraction of theſe veſſels themſelves, we may eaſily ſee why frictions, warm, penetrating, and ſtimulating applications, are often more ſucceſsful than internal medicines, in removing obſtructions in the ſmall veſſels; ſince they not only contribute to attenuate the obſtructing matter, but greatly increaſe the oſcillatory motion of thoſe veſſels."

Simple frictions, with coarſe cloths or flannels, will in general anſwer the purpoſe very well; but they will be more effectual, if hair cloth or bruſhes are made uſe of. In order, however, to derive the greateſt advantage from them, it has been common to make uſe of ſome ſtimulating medium, as ſalt—ſpirits—or the volatile alkali. Frictions with ſalt (independent of the preſſure on the veins) acts merely by its angles fretting the ſkin and producing pain: but as the faculty of ſenſation, or the perception of pain, is totally deſtroyed, it may juſtly be doubted, whether any good which may ariſe from it, will not be counterbalanced by the inconveniences attending its uſe; for if the operation is long continued, it will prove fatiguing to the aſſiſtants; and as conſiderable excoriations are very ſoon occaſioned, it is probable, if the perſon ſhould recover, they might be attended with unpleaſant conſequences. This conjecture is ſupported by the caſe of a boy, related by Dr. Houlſton, who fell into a pit containing a very ſtrong ſolution of rock ſalt, where he remained near fifteen minutes; though ſoon after he was taken out, he diſcovered ſome ſigns of life. In about an hour, he was pretty well recovered; yet he lived only two days: the ſkin inflamed, and ſwelled prodigiouſly; the mouth, throat, and probably the whole inteſtinal canal, were excoriated; and he died after two days in great agony, apparently from the ſtimulus of the ſalt ley. For theſe reaſons I have ſeldom uſed ſalt as a medium, but have generally had recourſe either to ardent ſpirits, or the volatile alkali, which, by penetrating into the pores of the ſkin, may probably cauſe an irritation and contraction in the coats of the capillary veſſels to which they are applied.

Mr. Amonton, Mr. Richman, and Dr. Cullen, have by a variety of experiments proved, that fluids in evaporating produce ſome degree of cold: and the latter of theſe gentlemen imagines, that this power is nearly according to the degree of volatility in each. The quick lime ſpirit of ſal ammoniac, he found to poſſeſs this property in the higheſt degree; and by ſpirit of wine, the mercury in the thermometer was made to ſink from 44° to below the freezing point. On this account I am in doubt, whether the volatile alkali, or ardent ſpirits, may not in evaporating generate ſo much cold on the ſurface of the body, as may counteract our intentions, and prove prejudicial: and as the fumes of the volatile alkali very much affect the eyes of the aſſiſtants, and thereby prevent their doing their duty properly (an objection to which the patent muſtard is alſo liable) I am of opinion they ſhould be given up in favour of a liniment with ſtrong ſpirit of vitriol and ſweet-oil, which, when freſh made, has the property of generating, inſtead of diminiſhing heat; or, what I think ſtill better, a ſtrong camphorated oil, which, at the ſame time that it is exempt from the above inconveniences, is powerfully ſtimulating, of a pleaſant flavour, and will allow of being uſed a long time without fatiguing the aſſiſtants; a circumſtance which deſerves our attention, when the operation is ſometimes required to be performed ſeveral hours. After theſe, I ſhould prefer the concentrated vinegar, which may be procured in abundance, by repeatedly freezing and ſeparating all its watery particles.

Frictions are almoſt always the firſt article which is flown to for aſſiſtance, and in general they are immediately ſet about with great violence; but we have juſt now ſeen, that their principal effect is to drive the blood, from all parts of the body, towards the heart and lungs: now, from our previous knowledge of the ſtate of the vital organs, we are certain, that the venæ cavæ, the right auricle and ventricle of the heart, the pulmonary artery, and the veins of the brain, are already in a ſtate of diſtention; it is evident, therefore, that this treatment is much better calculated to deſtroy than increaſe the ſmall remains of life. I much fear, many, who might have been recovered, have fallen victims to ſuch untimely zeal; and I cannot avoid conſidering this method of proceeding, as one material obſtacle to a more general recovery. Frictions, then, ſhould not on any account be attempted, until the firſt indication, the removal of the preſſure of the brain, and the congeſtion of the heart and lungs, is effected: even then they ſhould be gentle, and ſhould be increaſed by ſlow degrees, leſt the tender veſſels ſhould be ruptured by an over haſty accumulation. Artificial reſpiration, as well as electricity, ſhould frequently be interpoſed, in order to tranſmit the blood from the right to the left ventricle, and to expedite its paſſage through the vaſcular ſyſtem.

Changing the poſition, and agitating the body, will, by gently rubbing the viſcera together, produce nearly the ſame effect in the internal parts, as frictions on the extremities; they ſhould therefore be frequently uſed: but, as it is well known that violent agitation affects thoſe in high health with giddineſs, faintneſs, and other ſymptoms of debility, the abſurdity of ſuch practice is ſufficiently evident.

LOCAL STIMULANTS.

1ſt. Aromatic and irritating medicines thrown into the ſtomach.

Mr. Hunter affirms, that the ſtomach ſympathiſes with every part of an animal, and that every part ſympathiſes with the ſtomach, but that this ſympathy is ſtrongeſt with the vital parts; "therefore," ſays he, "whatever acts upon the ſtomach as a cordial, or rouſes its natural or healthy actions, and whatever affects it ſo as to produce debility, has an immediate effect upon every part of the body."

This fact, which is well known and eſtabliſhed, ſtrongly points out the propriety of conveying ſtimulating medicines to this centre of ſympathy; ſuch as vitriolic ether; any of the eſſential oils, as cinnamon, nutmeg, or peppermint; the volatile alkali; or ardent ſpirits properly diluted: by theſe the nerves of the ſtomach will be irritated, and the ſame ſenſation will be conveved throughout the whole ſyſtem. The method of exhibiting theſe is by a ſyringe with an elaſtic pipe; a very uſeful inſtrument, contrived, I believe, by Mr. Hunter.

It is probable, however, that the moſt powerful and general ſtimulus we can apply in this way, is an emetic. I am well aware that it may be objected to by ſome, as cauſing fulneſs of the veſſels of the brain; and by others, as, inducing nauſea and debility, it will depreſs the powers of life: theſe inconveniences may, I conceive, be avoided, by waiting till the congeſtion of the head is removed, and then employing ſuch ſubſtances as excite vomiting as ſoon as they are taken into the ſtomach, as the white or blue vitriol, both of which act without occaſioning any previous nauſea.

2dly. Aromatic and irritating medicines injected into the inteſtines.

The periſtaltic motion of the bowels is known to continue ſome time after the action of the heart has ceaſed; and from this it is concluded, that the irritability of the former may remain longer than the latter. Of the firſt I am perfectly ſatiſfied, having ſeveral times ſeen it in quadrupeds: but of the laſt I am by no means convinced; for I ever obſerved, that when once the motion had ceaſed, it was ſcarcely to be excited again, either by electricity, pricking with a knife, or blowing warm air into their cavity: hence I am led to believe, that ſtimulants applied to this part will in general fall ſhort of their intended effect.

But granting for a moment, what I do not conceive can be proved, that the abdominal viſcera retain that peculiar property which enables their muſcular fibres to contract, on being ſtimulated, longer than any other organ, and allowing it poſſible that the ſame ſenſation ſhould be conveyed throughout the whole ſyſtem; yet ſurely the method we are directed to take to effect this purpoſe, that of throwing up the fumes of tobacco, is of all others the moſt unlikely to anſwer. Let us examine the effects which this celebrated and favourite remedy produces in the animal economy; we may then perhaps judge, whether it be entitled to the popularity and preference which it now ſo eminently enjoys.

The common effects of tobacco, when given internally in ſmall doſes, either by the mouth or rectum, is, according to Dr. Lewis, to prove violently cathartic and emetic, occaſioning extreme anxiety, vertigo, ſtupor, and diſorders of the ſenſes. Dr. Fowler ſays, gliſters of the infuſion (one dram of the plant to half an ounce of water) poſſeſs an anodyne, relaxant effect on the ſyſtem in general, and a ſtimulating effect on the rectum. Newman ſays, the oil, from repeated trials, has been found poiſonous to ſundry animals; and Dr. Dedier, that a drop or two of it preſently kills a cat or a pigeon. The Abbé Fontana found vomiting to be the conſtant effect of the oil, when applied to a wound, and loſs of motion in the part to which it was applied: but in none of his experiments did it occaſion death. Without multiplying quotations, which it would be very eaſy to do, what has been ſaid from the above reſpectable authorities is ſufficient to prove, when it is uſed in any quantity, that it poſſeſſes a relaxing, nauſeating, deleterious, and poiſonous property: there can be no doubt but its effects are nearly the ſame, whether taken into the ſtomach, injected into the bowels, or applied externally; and it is of little conſequence, whether the ſmoke, infuſion, or decoction be uſed, provided the ſame quantity of the herb be employed in each, ſince upon its eſſential oil do theſe properties appear to depend *.

Tobacco gliſters, in ſtrangulated herniæ, and violent conſtipations of the bowels, are in univerſal eſtimation. I have ſometimes, it is true, ſeen them ſucceed when every other remedy had appeared unſucceſsful; but it is no leſs certain, that I have in many inſtances ſeen them not only fail, but produce very alarming ſymptoms: and in more than one caſe, where they were perſiſted in too long, death itſelf, unleſs I am much miſtaken, has been the conſequence.

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* Let it be remembered, however, that gliſters of the infuſion or decoction ſeldom contain more than one dram of tobacco; whereas, when the ſmoke is uſed in caſes of apparent death, one or two ounces are generally conſumed, and ſometimes a larger quantity: now, if unpleaſant conſequences do happen from the ſmall quantity of oil, and which is much diluted, how much reaſon have we to expect, that the large quantity of oil extricated from the latter, and depoſited in a ſeparate ſtate, will be attended with the very worſt effects?

Conſidering all circumſtances, then, is it not a juſt inference, that although tobacco may at firſt act as a ſtimulus, yet it will afterwards, by its narcotic and deleterious properties, not only counteract what it has accompliſhed, but will aboliſh what before exiſted?

Although I am by no means ſatisfied, that the irritability of the inteſtines is either ſo conſiderable, or remains ſo long after death, as is generally ſuppoſed; yet, as a portion of the inteſtines retain their warmth, probably, longer than any other part; and as we have ſhewn that heat and irritability are always connected; and likewiſe as the periſtaltic motion is ſometimes ſpontaneouſly renewed after it has ceaſed; the application of ſtimulants to this part ought by all means to form an article of our proceſs.

Mint, peppermint, camomile, or wormwood, as containing abundance of warm, penetrating, aromatic oil; as they poſſeſs purely a ſtimulating, without any debilitating property; and as being readily kindled—ſeem well adapted for this purpoſe.

It does not immediately appear, why the ſmoke of any ſubſtance is ſo much to be preferred, or, indeed, why it ſhould be preferred at all; ſince, if we conſider the ſubject fairly, we ſhall find, that heat—irritation—and diſtention—are not only the principal, but the ſole effects, we have any reaſon to expect it to produce. Now, if no further benefit be expected, it ſhould ſeem that the ſame effects may juſt as effectually be obtained, by diffuſing a certain proportion of any eſſential oil in a large quantity of warm water; and this practice is certainly entitled to preference, becauſe the one requires a large, cumberſome, and expenſive apparatus, whereas the other may be commodiouſly adminiſtered in the common manner.

I object to the enema fumoſum on another principle: it is the common practice to begin with it, and to continue vigorouſly injecting it till all the operations are concluded. By this means the bowels are conſtantly kept in a ſtate of violent diſtention; the aorta and inferior vena cava will therefore be compreſſed; the paſſage of the blood through them will be materially impeded; and the vital organs muſt in conſequence remain overloaded.

3d. Particular ſtimuli adapted to the different organs of ſenſe; as

a. Light thrown on the eye.

The ſenſe of pain which accompanies the ſudden application of ſtrong light to the eye, has been experienced by every one; and the immediate connection that exiſts between the retina, which is ſuppoſed to be an expanſion of a portion of the brain, and the ſenſorium commune, ſtrongly points out the propriety of having recourſe to that experiment at this time. A taper will, I ſhould imagine, anſwer very well; but when an opportunity offers of throwing the rays of the ſun, concentrated by a double convex lens, on the retina (agreeably to the recommendation of Dr. Fothergill) its effect will certainly be much more powerful *.

b, Great noiſes directed to the ear.

It has been ſuppoſed, that the ſenſe of hearing remains longer in drowned perſons than any of the other ſenſes: whether it really does, I am not able to ſay; no inconvenience, however, can ariſe from making the trial; and, ſhould the ſenſitive principle remain, it may probably prove uſeful.

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* A drop or two of ſtrong volatile alkali let fall into the internal canthus of the eye, occaſions ſuch intenſe pain, that I have ſeen many apoplectics, who were totally inſenſible to ſcarifications and the ſtrongeſt light, exhibit evident ſymptoms of acute ſenſation, when it has been applied: on this account, I ſhould recommend it in the preſent inſtance.

c. Acrid liquors applied to the tongue and palate.

d. Sternutatories to the noſtrils.

The whole cavity of the mouth and noſe is naturally very ſenſible: the moſt effectual method of renewing its ſenſation will probably be, by throwing into it air ſtrongly impregnated with the volatile alkaline vapour; or the juice of onions or garlic, or muſtard or pepper, may be rubbed on the tongue, palate, and fauces; and ſnuff may be blown into the noſtrils.

e. Scarifications, the actual cautery, &c. to the ſkin.

Medical hiſtories furniſh us with ſeveral melancholy inſtances of the efficacy of ſcarifications and inciſions, in recovering thoſe who were ſuppoſed dead. The great Veſalius, the moſt eminent anatomiſt of his age, who firſt ventured to detect the errors of Galen, and who was very near preventing our countryman, Harvey, from having the honour of diſcovering the circulation—in opening the body of a perſon of conſequence, whom he had attended, and thought to be dead, perceived, when it was too late, his fatal error; for, on penetrating the cheſt, he found the heart palpitating. He was accuſed and condemned as a murderer; but by the interpoſition of the King of Spain, his ſentence was mitigated. It is ſaid that Cardinal Spinola, when he was about to be embalmed, thruſt away the hand of the ſurgeon who performed the operation: and it is related by Terelli, that a Spaniſh lady being ſuppoſed dead, a celebrated anatomiſt was employed to open the body, but that on the ſecond ſtroke of the inſtrument ſhe diſcovered evident ſigns of life. P. Peu, the celebrated French accoucher, candidly relates, that being importuned to perform the Cæſarian operation on a woman whom he ſuppoſed poſitively dead, perceived, when it was too late, by the motion of the body, the grinding of the teeth, &c. that he had been fatally miſtaken. Theſe caſes, the truth of which are but too well confirmed, clearly point out the propriety of adopting ſimilar, though more innocent meaſures. Scarifications, therefore, or veſications raiſed by fire on various parts of the ſkin, gradually plucking out hairs, and beating the palms of the hands and ſoles of the feet, ought with prudence to conſtitute a part of our proceſs.

Let it be obſerved, as an invariable rule, that in all attempts to recover the drowned, our attention ſhould be principally and primarily directed to—the adminiſtration and proper regulation of the inflation of the lungs—and the application of heat. Theſe, with the occaſional uſe of blood-letting, I conſider as abſolutely neceſſary to put the body in a ſtate proper to be acted upon, either by the inherent powers of the conſtitution, or the ſtimulating remedies generally uſed. Without theſe, I can never expect a recovery (unleſs the remains of life are very great indeed) even if the treatment be in every other reſpect unexceptionable: and with them, I am much diſpoſed to believe, that the greater number of thoſe who are recoverable, will be brought to life. The various other methods therefore, however highly extolled, are to be conſidered only in a ſecondary view, and conſequently ſhould by no means interfere with their application. It is matter of material conſequence, and extremely fortunate, that the greater number of them, indeed the whole, except the injections into the ſtomach, are of ſuch a nature, that they may be employed at the ſame time, without claſhing, or oppoſing each other's effects *.

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* When I have electrified the body, all the other operations have been ſuſpended, leſt the aſſiſtants ſhould receive the ſhock, inſtead of the patient; which may very readily happen, as the living body is a much better conductor of the electric fluid than the dead: a very ſimple contrivance will prevent the occurrence of this circumſtance,

It is neceſſary to obſerve, that particular attention ſeems requiſite when the ſymptoms of life make their appearance: it will then be adviſeable to ſlacken our operations, and leave as much to the exertions of the conſtitution as may be done conſiſtently with prudence. At firſt, when the ſymptoms are very weak, little alteration will

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ſtance, and will at the ſame time allow us to make uſe of the ſhock while the perſon is in the warm bath, or ſurrounded with hot grains; which we otherwiſe could not do, on account of the conducting property of the water. It is merely two pieces of braſs-wire, each two feet long, incloſed in glaſs tubes, or wooden caſes well varniſhed, with knobs at one end, and rings at the other: the knobs are to be applied like common directors, to thoſe parts between which we intend the fluid to paſs; and one ring connected with a chain or metallic ſtring, coming from the electrometer, and the other with a chain joined to the outſide of the vial, which will be more convenient if ſuſpended on the prime conductor. In this manner, ſhocks may be ſent through any part of the body; and their direction conſtantly varied, without a probability of the aſſiſtants receiving any inconvenience.—See Plate I.

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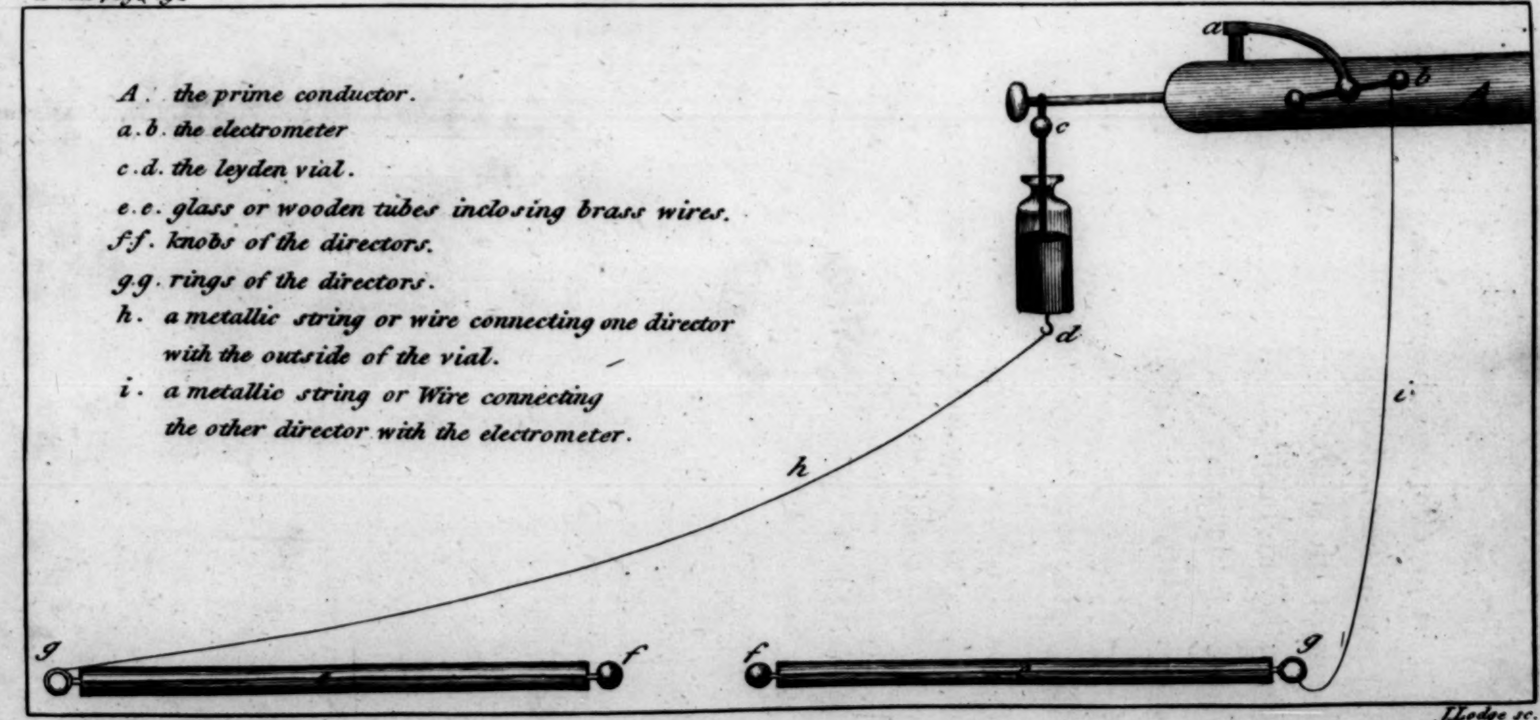
Plate I.



A. the prime conductor.
a. b. the electrometer
c. d. the leyden vial.
e. e. glass or wooden tubes inclosing brass wires.
f. f. knobs of the directors.
g. g. rings of the directors.
h. a metallic string or wire connecting one director with the outside of the vial.
i. a metallic string or Wire connecting the other director with the electrometer.

J. Lodge sc.

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IN THE RECOVERY OF PERSONS APPARENTLY DEAD FROM DROWNING, THERE ARE TWO INDICATIONS:

I. To remove the compreſſion of the brain, and the congeſtion about the heart and lungs.

II. To excite the irritability of the muſcular fibres.

I. The removing the compreſſion of the brain, and the congeſtion about the heart and lungs, may be effected by,

1. Bleeding, either
   - *a.* From the jugular veins, or,
   - *b.* Cupping and ſcarifications.
2. Artificial reſpiration, with
   - *a.* Common air.
   - *b.* Warm air from the lungs.
   - *c.* Dephlogiſticated air.
   - *d.* Air loaded with acrid and irritating effluvia; as,
     1. Of tobacco,
     2. Of volatile alkali,
     3. Of ſpirit of ſalt,
     4. Of ſpirit of ſulphur.
3. Proper poſition.

II. The exciting the irritability of the muſcular fibres may be done by,

1. General ſtimulants; as,
   - *a.* The proper application of heat, by
     1. Warm room,
     2. Warm bath,
     3. Warm grains,
     4. Natural warmth,
     5. Warm ſubſtances to various parts.
   - *b.* Electricity.
   - *c.* Frictions, with
     1. Coarſe cloths,
     2. Flannels,
     3. Hair cloth,
     4. Bruſhes,
     5. Camphorated oil,
     6. Concentrated vinegar,
     7. Volatile liniment,
     8. Ardent ſpirits,
     9. Muſtard,
     10. Common ſalt.
   - *d.* Gentle concuſſions.
2. Local ſtimulants; as
   - *a.* Aromatic and irritating medicines thrown into the ſtomach; as,
     1. Emetics,
     2. Etherial ſpirits,
     3. Eſſential oil,
     4. Volatile alkali,
     5. Ardent ſpirits.
   - *b.* Aromatic and irritating medicines injected into the inteſtines; as,
     1. The oil, decoction, powder, or fume of aromatic ſubſtances.
   - *c.* Particular ſtimuli adapted to the different organs of ſenſe; as,
     1. Light thrown on the eye, either that
        - *aa.* Of a taper, or
        - *bb.* Of the concentred rays of the ſun.
     2. Great noiſes directed to the ears.
     3. Acrid liquors applied to the tongue and fauces; as,
        - *aa.* Volatile alkaline vapour,
        - *bb.* Juice of onions or garlic,
        - *cc.* Muſtard or pepper.
     4. Sternutatories applied to the noſtrils; as,
        - *aa.* Strong ſnuff,
        - *bb.* Volatile alkaline vapour.
     5. Scarifications, or the actual cautery to the ſkin.

be required; but when they become more conſiderable, it is probable that our ſafeſt and moſt effectual practice will be, occaſionally aſſiſting, rather than importunately urging, the action of thoſe organs which are the moſt defective, and which, on this account, ſeem more particularly to require our attention and ſupport.

It may be of ſome ſervice to have the whole of the method of recovering drowned perſons collected into one view, as in the oppoſite table.

Nothing ſeems more eſſentially neceſſary for the improvement of the reſuſcitating art, than a large and diverſified ſtore of accurate hiſtories of perſons apparently dead from drowning, and other cauſes: indeed, till we can obtain ſuch a properly accumulated maſs of hiſtory, it is in vain to expect that our knowledge of this ſubject can be at all extended. There was reaſon to hope, from the plan and exertions of the Humane Society, that by this time we ſhould have been in poſſeſſion of ample and very ſufficient information on this head; but, notwithſtanding the number of caſes that have with great trouble been collected together, it is too true, that but a very ſmall proportion of them convey information even of the moſt common and neceſſary circumſtances. This inconvenience might readily be overcome, would the Society agree not to beſtow rewards, either in ſucceſsful or unſucceſsful caſes, without receiving, from the perſon who ſuperintended the caſe, a particular account of every circumſtance which occurred while the body was under his direction. This, it appears to me, would very ſoon procure us that information we ſo much ſtand in need of; and it would, moreover, be productive of another advantage, in preventing numerous applications on trivial accounts. The only ground on which this propoſal may be objected to is, on account of the trouble it would occaſion to the medical aſſiſtants; ſome of whom, rather than be at the inconvenience of ſtating ſuch a particular account, would not communicate what had occurred under their direction. There are but few, I truſt, to whom this argument can be applied: but if a regular plan was drawn up, containing every article neceſſary to be informed of, there could be no objection to it. With this view, the following ſketch is laid before the Society; and it is ſubmitted to their conſideration, the propriety of ſending a copy to each medical aſſiſtant, with ſuch reſolutions annexed to it, as they may judge proper.

As an appendage to this, the plan of a general table is added, which is intended to exhibit, at one view, the whole of the hiſtory of drowned perſons, with the varieties which may occur in different caſes. The advantages that muſt ariſe from adopting this, or a ſimilar plan, are ſufficiently obvious.

In this table, the aſteriſks under the different heads point out the particular circumſtances that occur, or the remedies that are uſed. Where any remedy or remedies appear to be remarkably ſerviceable in bringing about the firſt ſymptom of life, a red aſteriſk is to be added likewiſe; and where they ſeem evidently and materially to aſſiſt in promoting the recovery, two common aſteriſks are then to be made uſe of.

The figures under the two laſt diviſions —the Return of Life—and the Complaints after

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Nº 2.

SKETCH of a PLAN for obtaining accurate HISTORIES of PERSONS apparently DEAD from DROWNING.

CIRCUMSTANCES PREVIOUS TO THE ACCIDENT.

1 Sex.

2 Age.

Conſtitution;—whether
3 Tonic,
4 Atonic,
5 Irritable.

6 Situation in life.

7 General health;—particularly whether ſubjected to, or prediſpoſed for, diſeaſes of
8 The brain,
9 The heart, or
10 The lungs,
11 Whether deformity or malconformation of any part, affecting or impeding the free action of thoſe organs.

12 Circumſtances increaſing the action of the heart and arteries;—as
13 Whether the body had been lately recruited by moderately good living.

14 Circumſtances diminiſhing the energy of the vital powers;—as
15 Debility, whether ariſing from
16 Previous fever,
17 Debauch, or
18 Violent cold.

AT THE TIME OF THE ACCIDENT.

19 In the water,
20 What length of time.
21 Whether he ſunk, and how often.
22 Whether all voluntary motion had appeared to ceaſe, and how long.
23 Whether he floated on his back or his belly, or in ſuch a manner as to prevent reſpiration.

24 Under water,
25 What length of time,
26 Whether he ſunk immediately,
27 In what depth of water,
28 In freſh, or very ſalt water.

29 Seaſon of the year, and temperature of the air.

CIRCUMSTANCES AND APPEARANCES AS SOON AS TAKEN UP.

30 The length of time that had elapſed between the taking up of the body and the application of proper remedies.

31 The manner in which, during that period, he had been treated;—as whether

32 The poſition in which he had lain would be likely to aſſiſt, or prevent, the general diffuſion of blood, more eſpecially the return of blood from the veins of the head.
33 The wet cloaths had been removed.
34 Expoſed to, or ſheltered from, inclement weather.
35 Suſpended by the heels, rolled in or over a caſk, or ſimilar improper treatment.
36 He had received any injury in the fall.
37 Immediately on being taken up, he diſcovered any ſigns of life.

38 Appearance of the body.
39 The face;—whether
40 Enlarged,
41 Livid,
42 Black,
43 Cadaverous,
44 Fluſhed,
45 Natural.

46 The Eyelids,
47 Livid,
48 Swelled,
49 Half ſhut,
50 Remaining open in any poſition they are placed.

51 The Eyes,
52 Bright,
53 Clear,
54 Glaſſy,
55 Inflamed,
56 Fierce,
57 Fixed,
58 Heavy,
59 Dull,
60 Obſcure,
61 Diſtorted,
62 Prominent,
63 Flaccid, or diminiſhed,
64 Pupil, contracted or
65 dilated,
66 Both pupils contracted equally,
67 Whether any, and what alterations take place in the pupils.

69 Jaws,
70 Fixed, or
71 Fallen.

72 Mouth and noſtrils,
73 Foaming at,
74 At what time.

75 Tongue,
76 Natural ſize, or
77 Enlarged.

78 Skin,
79 Pale,
80 Reddiſh,
81 Livid, } partial or general.
82 Flaccid,
83 Inelaſtic,

84 Stomach,
85 Diſtended,
86 Præcordia contracted,
87 On preſſure the contents evacuated.

88 Abdomen,
89 Diſtended,
90 Hard,
91 Soft,
92 Elaſtic,
93 Natural,
94 Fæces or urine expelled.

95 Joints and limbs,
96 Flexible,
97 Contracted,
98 Stiff.

99 Heat,
100 External, } aſcertained by the thermometer.
101 Internal,
102 Partial,
103 General.

THE METHOD OF RECOVERY.

104 Every individual remedy to be expreſſed.

105 The order in which they were uſed.

106 The length of time they were perſiſted in.

107 The benefit or diſadvantage which appeared to ariſe from the different remedies.

108 The particular remedy, or remedies, which ſeemed to bring about the firſt ſymptom of life; and

109 Thoſe that evidently aſſiſted in promoting the recovery.

AT THE RETURN OF LIFE.

110 The length of time the external ſigns of life appeared to be ſuſpended.

111 The firſt ſymptom of life.

112 The progreſſive order in which the other ſymptoms made their appearance.

113 Whether the ſymptoms aroſe from

114 The heart—cauſing
115 Palpitation;

116 The arteries—cauſing
118 Pulſation;—whether it be
119 Partial,
120 General,
121 Equal,
122 Irregular,
123 Natural,
124 Full,
125 Weak,
126 Quick,
127 Oppreſſed.

128 The lungs—cauſing
129 Gaſping,
130 Sighing,
131 Coughing,
132 Groaning,
133 Reſpiration;—whether
134 Regular,
135 Interrupted,
136 Difficult,
137 Laborious,
138 Snorting.

139 The ſtomach, or inteſtines—cauſing
140 Vomiting,
141 Expulſion of the fæces.

142 The muſcular ſyſtem—cauſing
143 Trembling,
144 Motion of any particular part,
145 Convulſions;—whether
146 Slight,
147 Violent,
148 Frequent,
149 Partial,
150 General.

COMPLAINTS AFTER RECOVERY.

151 Whether ariſing from a defect of
152 The vital functions;—as in
153 The brain—inducing
154 Pain,
155 Heavineſs, or
156 Giddineſs in the head,
157 Delirium,
158 Coma,
159 Paralyſis,
160 Convulſions,
161 In what part,
162 In what degree.

163 The heart and lungs—cauſing
164 Pain in the thorax,
166 In what part of it,
167 In what degree,
168 Fixed,
169 Wandering,
170 Conſtant,
171 Intermitting.

172 Reſpiration,
173 Difficult,
174 Laborious,
175 Wheezing,
176 Interrupted.

177 Cough,
178 Anxiety.

179 The natural functions;—as of
180 Deglutition,
181 Digeſtion,
182 The ſecretions,
183 The excretions.

184 The animal functions;—as thoſe of
185 Voluntary motion,
186 The internal ſenſes;—as
187 Perception,
188 Reaſoning,
189 Imagination,
190 Memory,
191 Judgment,
192 Paſſions.

193 The external ſenſes;—as
194 Seeing,
195 Hearing,
196 Smelling,
197 Taſting,
198 Feeling.

199 Symptoms indicating a fulneſs of the veſſels of the head;—as
200 Face bloated,
201 Eyes inflamed,
202 Noſe bleeding.

203 The degree and duration of theſe complaints, with the effect of the ſeveral remedies which were applied.

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N° 3.

SUCCESSFUL.

III mins under water.		IV mins under water.		V mins under water.		V mins under water.		VI mins under water.		VII mins under water.		VIII mins under water.		IX mins under water.		X mins under water.		X mins under water.		X mins under water.		X mins under water.		X mins under water.	
Minutes before recovered.	Number of the caſe.	Minutes before recovered.	Number of the caſe.	Minutes before recovered.	Number of the caſe.	Minutes before recovered.	Number of the caſe.	Minutes before recovered.	Number of the caſe.	Minutes before recovered.	Number of the caſe.	Minutes before recovered.	Number of the caſe.	Minutes before recovered.	Number of the caſe.	Minutes before recovered.	Number of the caſe.	Minutes before recovered.	Number of the caſe.	Minutes before recovered.	Number of the caſe.	Minutes before recovered.	Number of the caſe.	Minutes before recovered.	Number of the caſe.
Soon.	465	Soon.	66	s	84	15	365	* Uncertain.	16	s	98	s	7	20	356	s	30	s	258	*	414	15	396	30	471
30	80	30	97	10	67			70	372	5	101	s	316			s	51	s	358	*	130	15	497	30	68
60	49			15	355							s	p. 176			s	274	s	363	3	1	20	310	30	254
				45	78							s	307			s	293	s	371	5	315	20	279	30	259
				45	422							20	535			s	311	s	501	5	22	20	484	30	415
				120	419											s	405	s	566	10	74	25	2	60	277
				120	491											s	57	* Uncertain.	25	10	308	30	451	60	416
X		XII		XV		XV		XV		XV		XVIII		XX		XX		XX		XXX		XL		XLV	
60	487	s	305	s	320	10	21	20	(409)	60	354	30	307	s	12	20	437	60	164	*	103	40	(1)	120	315
60	488	3	260	s	239	10	(7)	20	250	60	368			s	503	20	482	90	312	45	593				
60	498	15	161	s	351	12	252	20	546	60	494			s	6	30	407	120	392	45	(11)				
90	318	20	289	*	(408)	15	65	30	59	120	357			10	138	30	(7)	180	410	45	p. 165				
90	390	30	268	*	105	15	249	30	553	120	408			10	p. 173	45	549			45	547				
105	489	40	276	*	267	15	496	40	265					15	472	45	348			60	165				
180	493			8	398	20	14	45	561					20	11	60	13			240	420				

UNSUCCESSFUL.

Minutes under water	Uncertain.	Few.	5	6	7	10	12	14	15	16	17	18	20	25	30	35	40	45	50	60	90	120	180
Number of Caſes	150	13	5	1	2	28	5	1	66	1	1	1	41	3	80	4	11	7	2	40	7	8	3

after Recovery—refer to the number of the articles in the preceding plan, where the particulars are explained more at large.

The table is divided into two parts, on account of its length.

It may not be amiſs to exhibit, at one view, the length of time that was employed in each of the caſes which are publiſhed in the Reports of the Humane Society (where that circumſtance is ſpecified) before the firſt ſymptom of life made its appearance: likewiſe the different length of time, which different caſes, that were under water for the ſame ſpace, required for their recovery; and alſo an account of the number of unſucceſsful caſes, with the length of time they were under water, on whom the ſame or ſimilar means had been employed.

ON THE SUSPENSION OF THE VITAL POWERS FROM HANGING.

THE proximate cauſe of death, in perſons who periſh from hanging, is a circumſtance which has engaged the attention of the moſt eminent men, both ancient and modern; but, after all, the anatomiſts and phyſiologiſts of the preſent day ſeem equally in the dark, and as much unſettled in their opinion, as their predeceſſors. Perhaps, however, it may not be amiſs to mention the different ideas that have prevailed, and ſtill continue to prevail, concerning it.

It was one of the firſt opinions, that death was occaſioned by the conſtriction of the nerves of the neck. The nerves of the neck have been tied in many and various animals: in a few it is ſaid to have proved mortal; but in by far the generality it did not produce that effect.

Others aſcribed it to a compreſſion of the carotid arteries. The experiment has been made of tying them; and the animal, in many inſtances, did not ſeem to labour under any very material inconvenience.

A third opinion is, that it proceeds from the compreſſion of the jugular veins: but all the larger veins of the neck, both internal and external, have been ſeparately tied, without apoplexy or even ſleepineſs having been induced. Further, it is related, that the carotid arteries and jugular veins being all tied in a dog, that he enjoyed the moſt perfect health and vivacity for ſome weeks! The ſame author, Emettus, obſerves, that upon repeating the operation often, although none of the dogs died, or were apoplectic, yet ſome of them, for the ſpace of a few hours, ſeemed ſleepy.

Some attribute it to a compreſſion of the ſpinal marrow: but this effect cannot often take place, without the vertebræ being either diſlocated or fractured; a circumſtance that is very ſeldom obſerved to occur.

With greater appearance of probability, do ſome impute it to the trachea being ſhut by the preſſure of the cord, and thereby preventing reſpiration. As I do not recollect to have met with any experiments or obſervations advanced againſt this theory, I take it for granted, it is now the generally received opinion; more eſpecially as Haller, De Haen, Dionis, Languthus, and ſeveral other great men, have attributed it entirely to this cauſe. Experiments I have none to adduce againſt it; but I am of opinion, if we attend to the mode in which the cord is fixed about the neck of thoſe unhappy wretches, and the parts on which it acts, we ſhall not conſider this affair as fixed on ſo firm a baſis, or ſo entirely devoid of objection, as it may at firſt ſight appear.

I never myſelf had a proper opportunity of aſcertaining theſe circumſtances; but from what my own ideas furniſh me with on the ſubject, I ſhould ſuppoſe the ſtricture generally happens either above or upon the thyroid cartilage: if above it, which I conceive happens the moſt frequently, notwithſtanding that the ſoft parts give way, yet there muſt be ſome room for the air to paſs into and out of the lungs; and if upon the cartilage itſelf, it is ſo firm and ſtrong, as to be ſufficiently capable of reſiſting the preſſure which is applied to it. If this then is the caſe (and I have no reaſon to induce me to think otherwiſe) I do not ſee how reſpiration can be ſo ſuddenly or completely ſtopped as to prove the cauſe of death.

Although I cannot admit the ſtoppage of reſpiration to be the ſole cauſe, yet I do not heſitate one moment in allowing it to be a principal one. Hence, if the breathing is materially impeded, the blood will by degrees be accumulated in the right auricle and ventricle of the heart, and in the whole venal ſyſtem : but the veins of the brain, for various reaſons, as we have ſhewn in another place *, will be ſooner diſtended than thoſe of any other part; the functions of that organ will conſequently ceaſe, and the appearance of death muſt then happen. If to this we join the additional reſiſtance the blood will meet with in its paſſage through the veins of the neck, all of which muſt neceſſarily be compreſſed, while at the ſame time the circulation through the carotid and vertebral arteries ſtill continues, they will both be perfectly ſufficient to account for the event.

Haller, De Haen, Petit, and Lanciſi, are of opinion that the cauſe of death reſides in the cheſt; while Boerhaave, Wepfer, and Littre, attribute it to apoplexy. I join the latter in opinion; and

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* Page 38, 39.

am perſuaded they are right, for the following reaſons.

It is true, we are circumſtanced nearly the ſame, with regard to the diſſection of thoſe who are hanged, as of the drowned; and but little confidence is, for the ſame reaſon, to be placed in the former as well as the latter *; but caſes are by no means wanting to prove, that the appearances on the body, and thoſe which occur on diſſection, as well as the ſenſations, and the complaints of thoſe who have recovered, indicate that the cauſe reſides in the head, inſtead of the breaſt. The appearances, on being cut down, very much reſemble thoſe of the drowned; that is, the face is ſwelled, and of a dark red or livid colour; the eyes are ſuffuſed, enlarged, and prominent; the features are diſtorted, and the tongue ſometimes thruſt out of the mouth. On diſſection, the veſſels of the brain have been found diſtended,

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* See page 30, et ſeq.

tended, and ſometimes blood has been extravaſated in conſequence of their being ruptured [*]. The ſenſations of thoſe who have ſurvived hanging, correſpond entirely with what I have already mentioned. In ſeveral inſtances it is related, that as ſoon as they were ſuſpended, ſparks of fire ſeemed to fly before their eyes; they were ſeized with ſtupor and loſs of ſenſe, and were not conſcious of any thing that afterwards occurred, till life was perfectly reſtored. Some reſpectable authors alſo relate, their having ſeen perſons apoplectic from hanging; and a caſe which ſome time ſince fell under my direction, puts that matter out of doubt.

A middle-aged man hung himſelf: after hanging, it was ſuppoſed, from three to five minutes, he was cut down. He was ſenſeleſs and ſpeechleſs; but his pulſe, reſpiration, and power of deglutition, ſtill remained. A ſurgeon was ſent for, who blooded him, and left him ſome medicine. I ſaw him about an hour and half after the accident, at which time he was in a deep apoplectic fit, attended with all the moſt violent ſymptoms of that ſtrongly marked diſeaſe. As he had been drinking, ſeveral emetics were exhibited, and purgatives given, both by the mouth and rectum; but they did not produce the leaſt effect. The pulſe being large and ſoft, made me dubious as to the propriety of another general bleeding; cupping glaſſes, therefore, were applied to the head and breaſt, and three or four ounces were drawn off by their means; frictions and ſtimulants were likewiſe had recourſe to: but after lying three or four hours, nature was no longer able to maintain the unequal conflict.

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[*] See the Caſes related at p. 54, et ſeq.

The next day the body was opened. The dura mater adhered very firmly to the inſide of the ſkull, and it required conſiderable force to ſeparate them. On removing the dura mater, the veſſels of the pia mater did not appear more diſtended than uſual; but I afterwards thought there was a larger proportion of blood in the veſſels of the brain in general, than I had obſerved in others. There was no inflammation on this membrane; but at that part of it which was immediately below the junction of the coronal with the ſigittal ſuture, it adhered to the dura mater on each ſide the longitudinal ſinus: theſe adheſions were eaſily ſeparated; the intervening ſubſtance was white, and about the dimenſions of a ſilver threepence. The ſame appearance was found in the middle portions of the membrane which cover the cerebellum, with this difference, that the ſame coagulable lymph was likewiſe between the cerebellum and pia mater, uniting them together. The brain in general was firmer than common. There was not more than the uſual quantity of water in the lateral ventricles, and that was of a red colour. The plexus choroides had the common vaſcular appearance,

ance, and there was no evident extravaſation of red blood either about it, near the origin or foramina of the nerves, or upon any part of the baſis of the ſkull. The cartilages of the trachea were all ſound, and they ſhewed no appearance of having ſuffered from compreſſion. There was nothing preternatural either in the thorax or abdomen, that could account for his death: no water in the pericardium. His heart was uncommonly fat; and his lungs were, without exception, the ſoundeſt I ever beheld—not a tubercle to be perceived—nor were they, any more than the heart, in the leaſt diſtended or overcharged with blood. The liver was hard, and beginning to grow ſchirrous. The ſtomach and inteſtines were in a very ſound ſtate: in the ſtomach was a ſmall quantity of half-digeſted food; its internal membrane had not the leaſt veſtige of inflammation or eroſion having been induced in conſequence of the emetics, &c.; and there was no feces in the rectum, or urine in the bladder.

This

This appears to me a caſe quite in point. The man, on being cut down, immediately breathed, as if reſpiration had not been diſcontinued; but he was in a ſtate of the moſt profound apoplexy. On diſſection, nothing preternatural was diſcovered, in either of the vital organs, which could be ſuppoſed capable of cauſing death; and the trachea ſeemed in a perfectly natural ſtate.

Be the cauſe of death, however, induced in whatever manner it may—whether as I have mentioned, or by the joint compreſſion of the trachea, arteries, veins, and nerves of the neck, or in any other way—what has been ſaid will, I conceive, be thought ſufficient to prove, that thoſe who die from hanging, ſuffer in conſequence of preſſure on the brain. Thoſe who periſh from drowning, we have found to ſuffer from the ſame cauſe. They ought, therefore, to be treated in preciſely the ſame manner: the compreſſion of the brain ſhould be removed, and the irritability of the muſcular fibres ſhould then be excited. The method of effecting theſe intentions, we have fully explained, when treating of the recovery of the drowned; there can be no occaſion, therefore, for repeating them in this place.

ON THE SUSPENSION OF THE VITAL POWERS BY NOXIOUS VAPOURS.

ANIMALS who are deſtroyed by mephitic vapours, ariſing from fermenting liquors, charcoal, the calcination of metals, and other ſources, do not appear to ſuffer the ſame kind of death, either as the drowned, or thoſe who are hung; ſince they are obſerved, in general, to be killed in a ſhorter time: their limbs remain much longer flexible after death; and their blood is commonly fluid. It is very evident, however, that the cauſe which produced death in the former, has a very material effect in bringing it about in the latter; for the head, face, and neck, are violently ſwelled, the eyes protrude, and the tongue is thruſt out of the mouth; the right ventricle and auricle of the heart, the pulmonary artery, the venæ cavæ, jugular veins, and veſſels of the brain, are all much diſtended with blood; and the ventricles of the brain frequently contain a quantity of bloody ſerum: all theſe circumſtances ſeem ſtrongly to indicate that they die apoplectic.

From a variety of circumſtances, I am induced to believe, that mephitic air occaſions apoplexy and death in two ways: firſt, by affecting the nerves of the trachea in ſuch a manner, as to render the muſcles ſubſervient to reſpiration paralytic; and, ſecondly, by its ſedative property, deſtroying the action of the brain and nervous ſyſtem. Were the noxious vapours to act merely in the latter way, I do not conceive there would be ſuch ſtrong appearance of diſtended brain: I am, on that account, inclined to ſuſpect, that they exert their effects principally on the organs of reſpiration. In oppoſition to this, however, I muſt obſerve, that it has been remarked by M. Bruquet, that the mephitic air does not penetrate into the lungs, becauſe their ſenſibility prevents its entrance; and that animals plunged into theſe fluids make continual efforts to inſpire, though without being able to accompliſh that end. But I am perſuaded this is not always the caſe, becauſe kittens that have been confined in jars of fixed air I have heard cry, and have repeatedly ſeen their cheſt and abdomen alternately enlarged and contracted.

Many inſtances are recorded of perſons ſuffocated by noxious vapours being perfectly recovered; and, as ſeveral are known to have revived ſpontaneouſly, without any aſſiſtance from art, it is probable a much greater proportion may be preſerved, if timely aſſiſtance be given, and proper reſtoratives uſed.

We have ſeen, that the moſt common kind of noxious vapour may, in ſome degree, and for a ſhort time, be inſpired into the lungs; in which place, as I ſaid before, it ſeems principally to exert its poiſonous effects. Our attention ſhould therefore be immediately directed towards correcting and expelling from that part what may remain in it. This may be done very effectually by inflating the lungs with dephlogiſticated or pure air, which ſeems well adapted to neutraliſe and correct all kinds of mephitic effluvia: the difficulty, however, of procuring it at all times in ſufficient quantity, and adminiſtering it conveniently, are impediments not eaſily overcome; till they can be ſurmounted, therefore, we muſt be ſatisfied by imitating natural reſpiration with atmoſpheric air: indeed, if care be taken to procure it cold, and tolerably pure (which may eaſily be done by Mr. Hunter's bellows, or a common pair adapted to any inflating inſtrument) I think it will anſwer this purpoſe very effectually; for the affinity which exiſts between phlogiſticated and dephlogiſticated air is ſo great, that the dephlogiſticated portion of the atmoſpheric air will combine with the mephitic vapour; and by frequently repeating the operation, its noxious property will ſoon be ſufficiently altered. Should the accident happen by air extricated from fermenting ſubſtances, which yield what is commonly called fixed air, the volatile alkaline vapour diluted, will probably anſwer very effectually. The introduction of this fluid into the lungs of drowned people is juſtly eſteemed a doubtful practice; but in the preſent caſe, ſhould too high a proportion of aerial acid remain in the cells of the windpipe, the alkaline air will neutraliſe and correct it, equally as well, if not better, than the dephlogiſticated air.

It is known by long experience, that expoſing bodies ſuffocated by the fumes of charcoal to intenſe cold, and making uſe of frictions of ſnow, are as ſerviceable as the contrary method is pernicious. It is, however, probable, that this practice may not be equally uſeful when death ariſes from every kind of noxious vapour, ſince we are informed, that a moderate degree of warmth, in thoſe ſuffocated by the fumes of burning limeſtone, has been found beneficial. M. Portal has remarked, that the heat remaining in the bodies of thoſe ſeemingly dead from noxious vapours, is greater than when alive, or at leaſt than is compatible with health: it is probably on theſe occaſions that cold may be neceſſary, to reduce the heat below the natural ſtandard, ſo as to proportion it to the ſmall degree of life which remains in the body, and by that means prevent the exertions which the conſtitution muſt neceſſarily make, in order to keep up ſo much heat; which effort of itſelf, while the powers of life are ſo low, would very ſoon be likely to prove fatal: but in thoſe caſes where the heat of the body appears nearly extinct, inſtead of uſing the cold applications, I apprehend it would be more prudent to have recourſe to moderate warmth.

In every other reſpect, the treatment of thoſe ſuffocated by mephitic vapours ſhould be exactly conformable to the directions given for the recovery of the drowned.

The ſalubrity of air in mines and caverns, is generally examined by means of a lighted candle; and implicit confidence is uſually placed in the fidelity of this teſt. It is matter of ſome importance, however, that this article ſhould be viewed in a proper light, or otherwiſe it may be productive of fatal miſtakes. Dr. Prieſtley, ſeveral years ſince, diſcovered a method of reducing nitrous and ſome other kinds of air, which in their firſt ſtate extinguiſh a candle, to a ſtate in which a candle burns in it, *quite naturally*, or with a *greatly enlarged flame*, though they ſtill continue as noxious as ever. The ſame gentleman, and others likewiſe, have obſerved, that ſometimes animals will live nearly as long in air, in which candles have burned out, as in common air. Perſons of delicate and irritable conſtitutions have been known to be attacked with dangerous ſymptoms from the air of coal-pits, &c. notwithſtanding that the candles have continued burning; and miners have been known to work many yards below where a candle would not burn.

Theſe circumſtances clearly prove, that the teſt of a lighted candle, if too much depended upon, may be productive of the moſt ſerious conſequences: it therefore ought, by all means, if not rejected, to be applied with great circumſpection and caution*.

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* It is probable, that the immediate or ſudden extinction of the redneſs of the wick, as well as the flame, would prove a more certain criterion.

ON

ON THE SUSPENSION OF THE VITAL POWERS FROM SYNCOPE.

THE cauſes of ſyncope are very numerous; but as I propoſe, at preſent, to confine what I have to ſay on this ſubject to the recovery of thoſe who are in that ſtate from loſs of blood, it will not be neceſſary for me to enumerate all thoſe cauſes here.

It is well known that this diſeaſe ſometimes takes place to that degree, that neither the pulſe nor reſpiration can be diſtinguiſhed; the body becomes cold, and the countenance ſeems clouded by death. Under theſe circumſtances, it is likely many may have really died, who with proper attention might have been reſtored; and it appears ſufficiently probable, that many of the ſtories related of perſons lying in trances, and many of the inſtances of premature interment, which are to be met with in Bruheir, Lanciſi, Kornman, Foreſtus, Luſitanus, &c. originated from this ſource*.

From

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* Many of theſe, notwithſtanding they are vouched for by men of reputed ſenſe and eminence, are of ſuch an extravagant nature as not to be credited: yet it is clear there muſt have been ſome foundation for ſuch uncommon ſtories, and that ſeveral have recovered a conſiderable time after they had appeared to be dead. A few of the moſt remarkable I ſhall ſubjoin.

Lanciſi De Morte Subitan. mentions his having ſeen a perſon of diſtinction recover, while the funeral ſervice was performing over him. Three ſimilar inſtances are mentioned by Pliny, in his Natural Hiſtory; one by Plutarch; and two by Dr. Craffts, of Neufchatel. Plato relates the hiſtory of an Armenian, who, twelve days after he was ſuppoſed to be ſlain, returned to life on the funeral pile. Pliny tells us, that Acilius Aviola, who had formerly been conſul, returned to life when he was upon the funeral pile, but was burnt alive. The ſame fate befel Lucius Lamia, who had been prætor: but Celius Tubero was more fortunate, having diſcovered ſigns of life in time to be removed. Monſ. Benard, a ſurgeon of Paris, ſaw a monk, who had been buried three or four days, taken from his grave

From a variety of conſiderations it appears neceſſary, that the brain ſhould always be preſerved in a certain degree of tenſion and firmneſs: and it is univerſally allowed, that the contraction of the auricles and ventricles of the heart ariſes from the ſtimulus of the blood thrown into

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grave alive, but he died immediately. A lady in Hampſhire was buried three or four days after her ſuppoſed death: the next day, a noiſe being heard in the vault, it was opened, and ſhe was found juſt expiring. Maximillian Miſſon tells us of Francis de Civille, of Rouen in Normandy, who is recorded to have been three times dead, three times buried, and as many times raiſed from the dead. Upwards of half a dozen ſtories are related of perſons who, being buried, were rouſed from their trance by the attempts which were made to rob them of valuable rings which they had on their fingers; and a greater number of inſtances are ſaid to have happened, where perſons being prematurely confined to their coffins, have not only devoured their ſhrouds, but have been reduced to the neceſſity of eating part of their own fleſh. Many more ſimilar caſes might be given; but, in all probability, what has been ſaid will be thought fully ſufficient.

their cavities. A certain quantity of blood is therefore neceſſary to effect theſe purpoſes: if it exiſts in a due degree, the vital actions will proceed properly; but any material alteration in this article will be attended with a deviation from health, and will endanger the conſtitution: an exceſs of it in thoſe parts will ariſe from ſuffocation; and a defect, from any circumſtance which cauſes a flow of blood into a new channel, or which diminiſhes its quantity.

Loſs of blood may, and probably does, operate in many ways with which we are unacquainted, ſo as to aſſiſt in producing ſyncope: it appears, however, to ariſe more particularly from the want of a ſufficient quantity of that fluid in the veſſels of the head, to preſerve the brain in a due degree of firmneſs and tenſion; whence a diminution or deprivation of the actions of that organ, and its appendage, the nervous ſyſtem. At the ſame time, the quantity of blood returned to the heart not being ſufficient to diſtend its cavities, the action of that organ muſt, for want of its uſual ſtimulus, be interrupted; and every appearance of death will conſequently enſue.

The vaſcular ſyſtem is, for the wiſeſt purpoſes, endued with the property of accommodating itſelf to the quantity of blood circulating in it: hence, when there is a redundancy of blood, or a plethora, the capacity of the veſſels is enlarged; when a deficiency of it, from hæmorrhage, or other violent diſcharges, happens, it will be diminiſhed. This expanſion or contraction can, however, take place but in a certain degree; for hæmorrhages are extremely liable to happen, if the plethora is increaſed; and faintings are very ready to occur, if the debilitating diſcharges are not ſoon checked.

From this view of the ſubject, we are led to a method of treatment, which ſeems the beſt calculated, that the nature of this dangerous ſituation will allow of, to reſtore life.

It ſhould, of courſe, be our firſt buſineſs to prevent, as far as may be in our power, any further return of the expence of blood: with this view, ſuppoſing the accident to ariſe from an external injury, the great veſſels, if they can readily be found, ſhould be tied with a ligature, or otherwiſe effectually ſecured, as our ſubſequent mode of treatment may be very likely to renew the hæmorrhage.

We ſhould then attempt to imitate the operations of nature, by producing a contraction of the veſſels ſufficient to act on their contained fluid. The contraction of the veſſels may be moſt effectually accompliſhed by—the application of cold—of frictions—and tight bandages.

The power of cold, in producing contraction in the living body, is ſo commonly and well known, as only to require mentioning, to be immediately allowed: if the ſeaſon be very cold, and other circumſtances permit, expoſing the body to the ſharp air will probably ſucceed; otherwiſe water artificially cooled, and daſhed in large quantities all over the body, will be more likely to anſwer this purpoſe. Of frictions we have already ſpoken very ſufficiently at page 170, and to which I now refer for what might here be ſaid on their effects. Cold and frictions act powerfully during the time they are uſed; but it is probable their effects are only temporary: to obviate this inconvenience, I would propoſe that bandages ſhould be applied to the abdomen and extremities; and if wetted with ſpirits, after they are applied, they would anſwer a permanently, and, I ſhould conceive, a powerfully good effect. By theſe means, then, the blood from all parts of the body will be driven to the vital organs, the veſſels of the brain will be diſtended, and the right auricle and ventricle of the heart ſufficiently filled with blood.

It is preſumed, that by this time the irritable principle will have ſo far loſt its natural vigour, as not readily to be excited:

cited: although, therefore, what we have juſt recommended are very powerful ſtimulants, as well as really neceſſary for putting the body in a ſtate proper to be acted upon, yet it is probable they may not of themſelves prove equal to the buſineſs: on this account, ſeveral articles of the ſame claſs ſhould be had recourſe to, ſuch as—the inflation of the lungs—the injection of aromatic or irritating medicines into the ſtomach—the dilatation of the inteſtines by large quantities of cool liquids thrown into them—certain ſtimulants applied to the different organs of ſenſe, &c. &c.—all of which were explained, both as to the manner in which they are to be applied, as well as the effects they will be likely to produce, when we were conſidering the recovery of the drowned; and as what was ſaid concerning them in that place will be equally applicable to the preſent purpoſe, there can be no occaſion to repeat it.

I am much diſpoſed to believe, that ſeveral who have no perceptible appearance of life, and who would ſoon be abſolutely dead, may be recovered by the means above mentioned: but there is great reaſon to fear, that, notwithſtanding the ſtricteſt attention be paid, either to this or any other plan we are in poſſeſſion of at preſent, that it will be impoſſible to recover many of thoſe whoſe vital powers are ſuſpended by this cauſe. But as our knowledge, as yet, by no means extends ſo far as to enable us to determine with preciſion who are, and who are not, to be recovered, we ought indiſputably to attempt all we can, in every caſe where there is the leaſt chance of ſucceeding; that is, where thoſe appearances we have before deſcribed, as the aſſociates of abſolute death, are not preſent; or even if they are, where, upon the application of the electrical teſt, the muſcular fibres exhibit the leaſt tendency to contraction.

As an inducement to others not to quit perſons in this dangerous ſituation, ſo ſoon as is uſually done, I will relate the particulars of a caſe which I attended; and I communicate it the more readily, as it is the firſt caſe of the kind which is publiſhed, and as it is the moſt remarkable inſtance of recovery from this ſtate, which, I believe, was ever met with.

On the ſecond of April 1782, B—— B——, ſhip-ſteward of the Glatton Eaſt Indiaman, about thirty years old, from ſome domeſtic unhappineſs, a very few days after he was married, came to the deſperate reſolution of putting a period to his exiſtence. The mode in which he choſe to effect the purpoſe was by cutting his throat; and this he did, by ſeveral ſtrokes, ſo completely, that it literally reached from ear to ear: part of each ſterno maſtoidæi muſcle, and both the external jugular veins, were divided; the cartilages of the trachea were ſeparated in two places; and a portion of the thyroid gland had been wounded.

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The action was committed between the decks: immediately after it was done, he was ſuppoſed to fall down; but the blood ran out in ſo large a ſtream, and with ſuch violence, that an officer who was walking the deck above, thought ſomebody had left the cock of one of the caſks running; with this perſuaſion he went down to rectify it, and found the unfortunate ſubject of this caſe in the ſituation I have deſcribed. A boat was immediately diſpatched for a ſurgeon; but the diſtance the ſhip lay from the ſhore prevented my being there in leſs than an hour.

Some time before I arrived, the poor fellow had loſt the external characteriſtics of life; the breathing and pulſation had entirely ceaſed; and the ſenſes of ſeeing, feeling, and hearing, were now, to all appearance, utterly deſtroyed. At this event I was not in the leaſt ſurpriſed, for the quantity of blood on the floor far exceeded what I before had an idea could be expelled from the body of any human being whatever; it was impoſſible to aſcertain it by meaſure, and it is not probable that our conjectures concerning it ſhould be at all accurate.

I at that time had heard much about the Humane Society; and the ſucceſs which attended their exertions in the recovery of the drowned, made me much wiſh to be called in when an inſtance of that kind ſhould occur. The recovery of the preſent caſe, however, at firſt appeared to me entirely out of the queſtion; for although the Society had hinted, that the hanged, the ſuffocated, the apoplectic, and the frozen, might be reſtored, yet no notice was taken of thoſe who are in a ſimilar ſituation from immoderate loſs of blood; and the man was, to all appearance, ſo perfectly dead, that even a hope of reviving him ſcarce entered my mind. I had, however, been favoured with ſome *animating* letters from Dr. Hawes, whoſe indefatigable exertions in promoting the intereſts of the Society—in extending the obſervations he has with ſo much care and aſſiduity collected—and in exciting and encouraging others to turn their attention to the recovery of the apparently dead—cannot be ſufficiently admired: theſe determined me not to quit the body immediately, but to treat it as if ſome degree of life actually remained.

The bleeding having ſtopped, it did not appear neceſſary to pay any particular attention to the wound; indeed, it was thought adviſeable to leave it open, that in caſe life ſhould return, the trachea might more readily be freed from the blood with which it ſeemed to abound*: the cloaths were therefore immediately removed, and

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* Mr. Children, an ingenious practitioner, now ſettled at Grays in Eſſex, who aſſiſted me in the recovery of this caſe, mentioned an inſtance which he had ſeen ſome time before, where the external wound was cloſed before the hæmorrhage had ſtopped: the conſequence was, that the blood fell into the windpipe, and the patient was very ſoon ſuffocated, dying in agonies ſcarcely to be conceived.

the body expoſed to a current of cool air; frictions were uſed to the body and extremities, and plenty of cold water was daſhed on the neck and face. When theſe means had been uſed for ſome time, we were moſt pleaſingly ſurpriſed, by a ſudden motion of the cheſt, attended with an inſpiration! In a moment the air was violently expelled, and with it a quantity of blood, that had fallen into the trachea: this expiration was attended with the moſt horrid noiſe I ever heard; and at this inſtant, particularly, our patient exhibited the moſt ſhocking and dreadful appearance it is poſſible for human nature to form a conception of. In leſs than a minute, the breathing was repeated, and in a ſhort time it became tolerably regular. The pulſe at the wriſt was not, on the firſt appearance of life, to be diſtinguiſhed; it was a conſiderable time before it beat diſtinct and regularly, and then it was extremely weak.

When the trachea appeared to be tolerably freed from blood, the edges of the wound were brought together, and retained by ſlips of ſticking plaſter; and the man now breathed freely through the mouth and noſe. In about three quarters of an hour after the firſt appearance of life, he began to form ſome idea of his ſituation: he did not expreſs any ſatisfaction at his eſcape, but appeared extremely diſtreſſed in his mind, and ſeemed to intimate, that he muſt continue wretched as long as he exiſted. Under theſe circumſtances, I did not think it prudent to rely totally on the plaſter, particularly as the conſtant diſcharge from the wound prevented its ſticking properly: I therefore made ſeveral ſutures, applied freſh plaſters, and brought the head forward on the cheſt, where it was retained by means of a proper bandage. He was then laid in a cool bed, an anodyne was given, and two careful men ordered to watch over him. I waited till he fell into a refreſhing ſleep, and then reſigned him to the direction of Mr. Cooper, the ſurgeon under whoſe care he properly fell, but who was abſent when the action was committed. The accident happened at two o'clock in the afternoon: when I left him, about ſeven in the evening, he appeared to be recovered beyond expectation; the pulſe and reſpiration were weak, but regular—the voluntary actions had returned—the external ſenſes of ſeeing, hearing, and feeling, were very perfect—and the internal ſenſes were at leaſt not in a worſe ſtate than before the accident.

The concluſion of this caſe I was extremely concerned to learn the next morning, from Mr. Cooper, the medical gentleman who attended. On awaking from his ſleep, he appeared cheerful, and ſaid he was much better—expreſſed a concern for what had happened—but entertained hopes, that all might end well. In conſequence of this favourable change, the perſons who watched him were not ſo attentive as they ought to have been: the unfortunate wretch took the advantage of their being aſleep, or otherwiſe employed; he tore off his dreſſings, and opened his wound; the hæmorrhage returned, and in a few minutes he ſunk into that ſtate he ſo ardently wiſhed for.

ON THE SUSPENSION OF THE VITAL POWERS FROM LIGHTNING.

NEITHER philoſophers or pathologiſts are at all agreed as to the manner in which thoſe people die who are killed by lightning. Signior Beccaria ſuppoſes, that it may ſometimes happen without the perſon being ſtruck by the lightning, merely from the effects of the ſuffocating vapour, with which the flaſh is always accompanied. Some have attributed it to the air in the lungs ruſhing out with ſuch violence, to ſupply the vacuum which is made near them, that they can never recover their breath: and others to the violent commotion in the atmoſphere acting in ſome degree ſimilar to the ſudden diſplacement of the air by a cannon-ball, which is ſometimes known to occaſion death, and frequently great inconvenience, although the cannon-ball itſelf had certainly not ſtruck the perſon ſo affected.

Such explanations, however, are extremely vague; they are not ſupported by any experiments; and are, in my opinion, inadequate to produce the effect attributed to them.

It appears ſufficiently evident, that every accident from this cauſe ariſes either—from the main ſtroke of a thunder cloud—from the lateral exploſion—or what is called the returning ſtroke: but the manner in which theſe operate, ſo as to produce death, is by no means certain. Inſtances are related of the ſmaller animals being killed by electricity, when, on being opened, moſt of the blood veſſels were ruptured, and the blood extravaſated: but this is not always the caſe; for Dr. Prieſtley could not perceive any ſuch effects, although he informs us that he made uſe of very ſtrong ſhocks on very ſmall animals.

That rupture, however, does ſometimes take place, is very evident. In the caſe of the unfortunate profeſſor Richman, who was deſtroyed by lightning, ſome blood ran out of his mouth;—in a duck which was killed by Mr. Henly, by a ſhock from a very large battery, the animal bled freely at the mouth;—and in a ſheep, which was ſome time ſince killed by the ſame means, the part of the brain through which the charge paſſed was much altered in its appearance, and the duplicatures of the pia mater torn to pieces *.

Were it allowable to theoriſe in a matter which ought to be entirely decided by experience, I would venture to ſay, that in thoſe caſes where the ſhock is very conſiderable, a laceration, or at leaſt a material

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* Many inſtances are related of animals killed by lightning, or electricity, becoming putrid in a very ſhort ſpace of time: but this does not invariably take place; and it may be doubted whether it occurs more frequently on theſe occaſions, than in other caſes of violent or ſudden death.

alteration in the texture, of the veſſels conſtantly takes place; not always univerſally, as electricians generally teach, but only in that part of the body which forms a portion of the electrical circuit. The effects which we can produce by the moſt powerful electrical battery are ſo extremely trifling, when compared with thoſe of lightning, that I ſhould imagine, in its utmoſt accumulation, it could only produce very partial conſequences: but a cloud of ten, twelve, or many more miles in length, diſcharging its main ſtroke of electricity on a perſon within its ſtriking diſtance, muſt be fully ſufficient to comprehend the whole of the body, and might therefore occaſion a general rupture of all the veſſels. This idea is corroborated by a circumſtance which was communicated to me by my friend Mr. Walker, the preſent ingenious lecturer on Philoſophy:— this gentleman, twelve hours after the accident, ſaw a girl that was killed by lightning; her whole body was black as ink, and the ſkin all over her was driven into ridges.

Upon the whole, and as far as I can judge from thoſe circumſtances which have paſſed under my obſervation, I ſhould conceive, that although we may not be able to explain the manner in which this moſt powerful of all agents operates, ſo as to produce death, more correctly than on many other occaſions; yet it ſhould ſeem in every inſtance, whether the cloud be poſitively or negatively charged, that (whatever be its other modes of operation) it exerts its principal effects on the brain and nervous ſyſtem, ſo as inſtantly materially to diminiſh, or totally overthrow, the principle of irritability: but as, according to its degree of ſtrength, it operates differently in producing this effect, and as it likewiſe cauſes different appearances, I think it adviſable to divide them into the following claſſes.—1ſt. When the ſhock is moderate, it merely ſuſpends the functions of life. In this caſe, I ſhould apprehend there would be no mark of external injury, nor that the organization of any of the vital parts would be deſtroyed.—2dly. When ſtronger, it deſtroys the principle of irritability. In this, ſome external marks may be evident; but there would probably be no perceptible miſchief on diſſection.—3dly. When in the moſt violent degree, it lacerates thoſe parts of the body through which the fluid paſſes; and the miſchief it occaſions in theſe caſes will be very evident in the internal parts, as well as on the integuments.

From this account it appears, that thoſe only who come under the firſt claſs are to be conſidered as in a ſtate from which a recovery can be expected; but as it may ſometimes be difficult to ſay whether the caſe falls under the firſt or ſecond, it will on ſuch occaſions be neceſſary, and on all others highly adviſable, to apply the electrical teſt before we determine that important queſtion.

That animals, to all outward appearance, totally deprived of life by artificial electricity, will often revive ſpontaneouſly, is well known to every one who has worked much at the electrical wheel; and that perſons apparently dead by a ſtroke of lightning, may be perfectly recovered, is now placed beyond all doubt.

As we have no reaſon to ſuppoſe there is any fulneſs in the veſſels of the brain, or accumulation in any part of the vaſcular ſyſtem, the drawing off blood does not ſeem at all indicated; on the contrary, diminiſhing the quantity of blood would, by abating the preſſure on the blood-veſſels, be likely to leſſen the ſmall remains of life: it ought, conſequently, never to be employed, at leaſt in any conſiderable quantity. Our attention ſhould therefore be chiefly directed towards exciting and reſtoring the principle of irritability: with this view, we ſhould immediately commence our operations with what, at firſt ſight, appears the moſt ineligible—the application of electricity; the very ſame agent which occaſioned thoſe evils we are now endeavouring to overcome. Upon further conſideration, however, there ſeems good reaſon for preſuming it may prove of very conſiderable utility in extricating our patient from his alarming ſituation. It is well known to be the moſt powerful ſtimulus we can apply; that it pervades the internal as well as affects the external parts; and that, beyond every thing, it poſſeſſes the property of exciting the irritability of the muſcular fibres. It has, moreover, been aſcertained by repeated experiments, that a moderate ſhock is peculiarly adapted to the recovery of animals whoſe vital functions have been ſuſpended by very ſtrong ones; and in this way animation may be alternately ſuſpended and reſtored, a conſiderable number of times, as I have often experienced. On theſe accounts, ſhould any accident of this kind occur in my practice, I ſhall be particularly anxious to avail myſelf of the advantages which I conceive will be very likely to reſult from the prudent exhibition of this celebrated remedy.

Although I cannot avoid conſidering this as an article of the firſt importance, yet I ſhould be ſorry to be underſtood as ſignifying, that it is the only one on which I would rely. By no means: every thing which ſtimulates the nervous ſyſtem, and which is likely to produce contraction in the muſcular fibres, I would adviſe to be employed. Inflation of the lungs I conceive to be moſt eſſentially requiſite in every ſpecies of aſphyxy; and although there may not in this caſe be any material congeſtion in the right ventricle or pulmonary artery, yet as it acts as a powerful ſtimulant, and as there is a very particular and ſtrong ſympathy between the heart and lungs, it ſhould be immediately employed. Frictions—emetics—and indeed all the remedies recommended for exciting the irritable principle in the drowned—

drowned—ſhould, under the reſtrictions and regulations there propoſed, be moſt aſſiduouſly and attentively perſiſted in for the full length of time directed by the Society; or, what will prove a better guide, till the irritability has entirely quitted the muſcular fibres; at which time, as I before mentioned, I conceive the perſon to be abſolutely and irrecoverably dead.

Aretæus Cappadox, who flouriſhed before the ſeventh century, in caſes of obſtinate epilepſy, perforated the cranium with ſucceſs. His example I have followed in one inſtance, where it anſwered the purpoſe moſt completely; for the perſon, before the operation, had thirty or forty fits in the day, and was furiouſly mad between each; whereas he never had one return, and immediately recovered his ſenſes, after the operation was performed. When, from external injury, blood is in any conſiderable quantity extravaſated immediately under the ſkull, trepanning is the only remedy: if there is an external wound, the extravaſation is in general readily found, which being evacuated, the patient not unfrequently ſoon recovers: but as the extravaſation may be on the ſurface of the dura mater—between the membranes of the brain—in its ventricles—or in the ſubſtance of the brain itſelf; and as there is no ſymptom or mark by which we can poſſibly diſtinguiſh in which of theſe places the extravaſation really took place, it will of courſe often happen, that on making the perforation no effuſion whatever is met with: yet many of theſe patients do well. I have in two ſuch caſes operated myſelf with perfect ſucceſs; and in a third, the ſymptoms were much alleviated by one ſmall opening; but no extravaſation being found, and not at that time being aware that the operation could anſwer in any other way than by removing an extravaſated fluid, the perforation was not repeated, and the boy died. From what has ſince occurred to me, however, I am much inclined to believe, that he might have been ſaved, had a greater portion of the cranium been removed. It is the practice of ſome eminent ſurgeons to apply the trephine, not only in thoſe caſes which are ſuppoſed to be of a mixed nature, that is, with ſymptoms of compreſſion, joined to what is called concuſſion—but in caſes of concuſſion only, without any external wound, where neither fiſſure, fracture, or extravaſation is ſuppoſed to exiſt: and ſuch practice, I am well informed, is attended with much better ſucceſs than the uſual mode of treatment. In the inflamed ſtate of the membranes, likewiſe, where bleeding and the other remedies have failed in procuring a diſcuſſion, moſt practitioners apply the trephine without waiting till matter is formed. In theſe, and indeed every other inſtance, the removal of a portion of the ſkull acts merely by relieving the compreſſed ſtate of the brain, and allowing it greater play: whence we can readily conceive, that although there be a general fulneſs of the veſſels of the brain, or that extravaſation may be ſeated in a remote part—yet that a proper opening in any part of the cranium will relieve the general over-diſtention; which circumſtance will likewiſe aſſiſt materially in expediting the abſorption of the extravaſated fluid.

From the conſideration of theſe circumſtances, and from the ſimilarity there appears to exiſt between ſome of the above caſes, and the ſtate of ſeveral of thoſe people whoſe ſituation we have juſt deſcribed, I am induced to imagine, that the operation of the trepan may be of ſervice in certain caſes of ſuſpended animation.

Much may unqueſtionably be ſaid in favour of it; and it ſhould ſeem, that but little can be urged againſt it: but as at preſent I am too much engaged to inveſtigate its merits with that attention it appears to deſerve, I muſt content myſelf merely with naming the circumſtance, and the inducements which firſt occaſioned me to think of it. Should it, upon further inveſtigation, appear that there are ſufficient grounds for preſuming it may be of ſervice, it is hoped that its novelty will not prove any impediment to its receiving an impartial trial; and I do not expect that the expoſure of the dura mater will be conſidered as any material objection to it, ſince there can be no compariſon between the inconvenience which may poſſibly ariſe from it, and the deſtruction which moſt probably will enſue, ſhould that operation be omitted.

ON THE PRESERVATION OF THOSE UNBORN CHILDREN WHO SURVIVE THE DEATH OF THE MOTHER.

IT is matter of very immaterial conſequence, both to the party concerned, as well as to the public at large, whether a life be preſerved or recovered. Hence we find that the Humane Society liberally recompence thoſe who are inſtrumental in preventing accidents by drowning; and great has been the number of thoſe who have been ſnatched from the moſt imminent danger by ſuch timely interference. It is obſervable, however, that in this country one conſiderable ſource of preſervation ſeems in a great meaſure, if not entirely overlooked: what I allude to is, the preſervation of thoſe unborn children who ſurvive the death of the mother. That ſuch caſes have often happened, will admit of no doubt; and that they do occur more frequently than practitioners are in general aware of, is from a variety of conſiderations extremely probable. It was with this idea that, in ſome well-regulated ſtates, laws were eſtabliſhed for the performance of what is uſually called the Cæſarian operation, on every woman who died far advanced in pregnancy; and thoſe who prevented or even retarded the operation, to the loſs of the fœtus, were ordered to be condemned and executed as murderers.

It was my intention to enter at ſome length into the merits of this treatment; but the ſhort ſpace of time which now remains to conclude this eſſay, will for the preſent prevent my doing it: but, to ſpeak truth, neither that, or the collecting together the many hiſtories which have tranſpired in its favour, appear

pear by any means really neceſſary. It may not, however, be unſeaſonable, juſt to mention a few circumſtances from a very uſeful work — the Embryologia Sacra of Cangiamila — a book highly extolled by the celebrated Van Swieten.

This author relates, that in the city and neighbourhood of Montreal, twenty-one living children had been extracted by this operation in twenty-four years. That in forty-four years, ſixty had been extracted at Caltaniſſecta, and five only were found dead. That in eighteen years, the Cæſarian operation had been performed twenty times in the city of Victoria in Sicily, and in every inſtance a living child was extracted. And at Sambuca, in Girgenti, eighteen living children were taken from two and twenty women who had died pregnant.

From theſe and a variety of other caſes, which are to be met with in different authors, not a doubt can I think remain, as to the propriety of having recourſe to the Cæſarian operation in every inſtance where a woman dies in the advanced periods of pregnancy.

The only objection which I am aware can be urged againſt it is, that it may be performed when the mother is not really dead, but in a recoverable ſtate. As this is a circumſtance which may poſſibly happen, it aſſuredly requires our moſt ſerious conſideration; particularly as we have before remarked the very ſtriking reſemblance that exiſts between ſyncope (by no means an uncommon occurrence, eſpecially in violent floodings) and actual death. We are, morever, called upon to be extremely circumſpect in this affair, ſince, as we mentioned in another place, P. Peu, a celebrated ſurgeon, and of very extenſive experience in the practice of midwifery, is ſaid to have performed this operation on a woman whom he thought abſolutely dead, but whom the event proved not to be ſo. Theſe circumſtances cannot fail exciting our moſt earneſt attention; but they ought by no means to preclude our having recourſe to the operation in thoſe caſes where we have ſufficient reaſon to imagine the woman can never recover. By diligently attending to the nature of the diſeaſe, and the manner in which the appearance of death has taken place; and by enquiring whether the perſon was formerly ſubject to faintings or hyſteric fits; we ſhall, I conceive, be enabled to form a juſt opinion of her real ſtate; which will, moreover, be confirmed, if, after uſing the moſt effectual remedies for a ſhort time, none of the ſymptoms of life make their appearance.

When the reality of death is determined, it is evident that the ſooner we perform the operation, the greater will be the probability of our ſucceeding. We are not, however, to be deterred from putting it in execution, even if by any means we ſhould be prevented having recourſe to it ſo ſoon as we could wiſh, ſince it is highly probable that the fœtus retains its life a conſiderable time longer than the mother. I have ſeen ſtrong motions in the fœtuſes of many quadrupeds, while they were incloſed in their membranes, ſeveral hours after the mothers were abſolutely dead. When theſe motions had ſpontaneouſly ceaſed, they were renewed by electricity, or pricking with the point of a knife, and might be continued for a very conſiderable ſpace. Many inſtances are likewiſe to be found in various authors, particularly in the book lately noticed, where the child ſurvived the death of the mother many hours. In the Encyclopædia Chir. Dolæus mentions a caſe where the child was obſerved to move in the mother's belly the day after her deceaſe: and the following is quoted by Van Swieten—" A woman with child was ſtabbed in ſeveral places by her huſband, out of whoſe womb a child was taken, by the Cæſarian operation, *forty-eight hours* after her death; and though it had been wounded in the foot through the pierced womb, it ſurvived during a quarter of an hour."

Every man who is at all converſant in the practice of midwifery, muſt ſeveral times have ſeen children reſtored to life, that were born without the leaſt appearance of any. With nearly equal propriety may we, in the preſent caſe, expect that many of thoſe who, when firſt extracted, do not exhibit any ſign of life, may by proper remedies be revived. Theſe remedies are the ſame in both inſtances; and the moſt effectual are found to be—inflation of the lungs—and the proper application of heat: theſe, with frictions, and the occaſional uſe of ſtimulants, will, I conceive, effect their intention in every inſtance where the child is in a recoverable ſtate. I would adviſe them to be applied in every caſe where the cuticle is not detached by putrefaction—or where, upon the application of the electrical ſhock, the fibres do not exhibit any tendency to contraction; and their uſe ſhould be perſiſted in ſeveral hours, as many inſtances have been known, where a recovery has been effected by long perſeverance only.

APPENDIX.

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The account of the following apparatus was not ſent to the Medical Society with the preceding Eſſay, as it was imagined it might lead to a diſcovery of the author: but as it was written with that intention, and as it is intimately connected with the ſubject, it was directed to be publiſhed at the ſame time.

APPENDIX;

CONTAINING

A DESCRIPTION

OF A

POCKET CASE OF INSTRUMENTS,

FOR THE

RECOVERY OF THE APPARENTLY DEAD.

THAT the principal cauſe of the want of ſucceſs in the recovery of the apparently dead, is the length of time that elapſes before the proper remedies can be applied, will admit of no doubt. It is equally certain, that this too frequently depends on circumſtances wholly out of our power to prevent: but it is no leſs true, that caſes terminating unfavourably often occur, to which, if proper and timely aſſiſtance could have been given, it is extremely probable they might have had a more fortunate concluſion.

With the view of obviating theſe inconveniences, it was propoſed to eſtabliſh general receiving houſes; and was that event to take place, it would undoubtedly be productive of great advantage: ſtill, however, on particular occaſions, much time muſt be loſt in conveying the body to thoſe places; and even when there, it does not appear that the Society are yet in poſſeſſion of a collection of inſtruments calculated to anſwer many of the moſt eſſential intentions in the method of recovery.

In the year 1775, an apparatus was contrived by Dr. Cogan, which was patroniſed by the Society: it ſoon came into common uſe, and has remained ſo to the preſent day. But this, which is certainly preferable to any thing of the kind that had preceded it, either in Holland or France, does not by any means ſeem calculated to afford that aſſiſtance the nature of theſe caſes really require. Its ſize is one material objection, occaſioning conſiderable delay in being removed to any diſtance: but it is liable to another much more ſo; for it contains little more, of any conſequence, than one inſtrument, the uſe of which (although the inſtrument is acknowledged to be perfectly competent to its intended purpoſe) muſt be attended with very doubtful, if not very pernicious conſequences.

From theſe conſiderations it evidently appears, that a regular and complete apparatus, comprehending a collection of all the articles and inſtruments which are requiſite on theſe occaſions, is much wanting; and that if they can be compriſed in a caſe which will admit of being conveniently carried about, it will prove a very conſiderable acquiſition to the reſuſcitating art.

Theſe deſiderata are now, I conceive, accompliſhed; and I have the pleaſure of offering to the conſideration of the Society, a collection which comprehends every article (except an * electrical machine) that appears to me really neceſſary on any of theſe occaſions, and nearly the whole of them are indiſpenſably requiſite in all: theſe are compriſed in a caſe which may conveniently be carried in the pocket.

In reviewing the various methods requiſite to be employed in the recovery of the drowned, our attention was firſt directed to the conſideration of the propriety of drawing off blood. When that queſtion is determined in the affirmative, it was ſaid that the operation would have better effect, if performed in the jugular vein; but as it ſometimes happens that no blood is to be procured from that part: and likewiſe, on account of the ſtimulus, cupping was recommended. If the pro-

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* The electrical machine muſt be excepted: a very ſmall one would anſwer for this purpoſe; but it is impoſſible to reduce its ſize ſo much as to bring it within the compaſs of this plan.

per inſtruments are not at hand, a ſufficient quantity of blood may be drawn off by means of coffee-cups, ſmall gallipots, wide-mouthed bottles, &c. and a common lancet will anſwer the purpoſe of a ſcarificator.

We have endeavoured to ſhew *, that reſtoring the ſuſpended action of the lungs is of the utmoſt importance in our attempts to recover the apparently dead, let the original cauſe be whatever it might; but that in the caſe of the drowned, where the ſuſpenſion of the vital powers proceeds from the ſtoppage of reſpiration, we ought, if poſſible, to be more particularly expeditious in the renewal of it; but as it is an operation which is uſually performed with great indelicacy and difficulty, and as it is frequently, at leaſt in the common mode, impoſſible to perform it at all—we have ſtrong reaſons for ſuſpecting that many lives may have been loſt for want of

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* Page 138, et ſeq.

proper and convenient inſtruments to accompliſh it.

Well convinced of the importance of this circumſtance, ſeveral gentlemen have turned their attention towards contriving inſtruments to effect it. It will be unneceſſary in this place to mention them, as they have already been noticed in the preceding eſſay; (ſee page 140, et ſeq.) All that is requiſite for me now to ſay is, that the following inſtrument (which is indeed one of thoſe there deſcribed) has, in every inſtance wherein I have tried it, anſwered the purpoſe very completely.

It conſiſts of an elaſtic tube about twelve inches in length; to the end of which is fixed an ivory or ſilver mouth-piece, or any common pair of bellows may be adjuſted to it by means of a hollow conical ſcrew; and to the other end an addition of ivory alſo, of ſuch a form as to enter and fill up a noſtril. It is thus uſed:

A proper perſon, ſtationed at the head of the body to be operated upon, paſſes the appropriated end of this tube into one of its noſtrils, and, ſuſtaining it there with the fore-finger, he compreſſes both noſtrils ſo firmly between the thumb and middle-finger of the ſame hand, that no air can paſs otherwiſe than by the tube; and the other hand applying the other extremity of the tube to his mouth, he blows with force through the pipe into the noſtril of the ſubject.

The medical director, ſtanding at the right ſide of his charge, muſt keep the mouth perfectly cloſed with his left hand, while with his right, making a ſuitable preſſure on the prominent part of the windpipe, he prevents the air paſſing into the ſtomach; till finding the lungs are properly diſtended, he is to preſs ſtrongly upon the cheſt, removing at the ſame time his left hand from the mouth, ſo as to let the air paſs out: when by theſe means the lungs are compreſſed, the ſame proceſs is immediately to be repeated, that, as far as can be, the manner of natural reſpiration may be imitated.

If any difficulty ſhould ariſe in diſtending the lungs, it muſt proceed either from water in the windpipe, or a contraction or adheſion of the epiglottis. We have already, at page 120, pointed out the method of diſcovering when the firſt circumſtance occurs; and if my experiments and reaſoning are to be depended upon, we have ſhewn the inutility, as well as impracticability, of removing it when it does take place. When the latter is the caſe, we ſhall generally remedy the inconvenience by bringing the tongue forwards, which being connected with the epiglottis, by almoſt inelaſtic ligaments, muſt of courſe be elevated. Should further impediments however occur, the pipe for the noſe is to be removed, and the crooked tube bent like a male catheter, recommended by Dr. Monro, and mentioned by Mr. Portal, Mr. le Cat, and others, is to be ſcrewed on the tube in its place: this is to be introduced through the mouth, or one noſtril, into the glottis, when, on blowing through the mouth-piece, or applying the bellows, the lungs will be dilated.

This laſt inſtrument is likewiſe much better accommodated for inflating the lungs, when in ſuch caſes trachæaotomy is performed, than the common diſſecting blow-pipe, the implement generally had recourſe to.

The introduction of ſtimuli into the ſtomach is deſervedly reckoned a material part of the proceſs: theſe may very conveniently be exhibited by means of a funnel and an elaſtic pipe. Should any obſtruction occur to the entry of the medicine, it will be overcome by applying the mouth to the funnel, and blowing upon the liquid, which will then readily paſs into the ſtomach.

If my objections againſt the uſe of the fumes of tobacco are founded on juſt principles, the apparatus in common uſe for that purpoſe will of courſe become unneceſſary: a large bladder, faſtened to an ivory tube, which may inſtantly be connected to a proper pipe, will be ſufficient therefore for this purpoſe; and a clyſter may immediately be formed, by mixing ſome of the vegetable eſſence with a large quantity of warm water.

But, even ſuppoſing I may be in error, and that the fumes, either of this or any other vegetable, may be of greater ſervice than a diluted ſolution of their eſſential oil, ſtill I do not ſee the leaſt occaſion there can be for a caſe ſo large and cumberſome: if the bowl which holds the fumigating ſubſtance is ſufficiently large to contain fuel for a very few minutes, it is ſurely competent to our purpoſe; for nothing can be more abſurd than the idea of keeping the bowels in a ſtate of moſt violent diſtention for two or three hours, without any intermiſſion! If therefore it be judged neceſſary, a fumigator of ſuch a ſize is occaſionally added, without materially increaſing

creaſing the bulk of the caſe: and this may be connected to any *common pair of bellows*, by means of a hollow conical ſcrew, or it may be worked by a blow-pipe.

The degree of vital or natural heat remaining in the body, and the degree of artificial heat which is proper to be applied, cannot be aſcertained or regulated with ſufficient preciſion without the aſſiſtance of a thermometer: one conſtructed upon Mr. Hunter's principle is therefore provided for theſe purpoſes.

It may not, in this place, be amiſs to obſerve, that ſimple frictions with flannels, cloths, &c. appear to be nearly, if not equally efficacious, as when any ſtimulating medicine is had recourſe to.

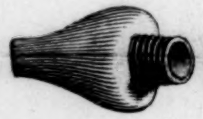
Proper vials, containing eſſence of any aromatic vegetables, as camomile or peppermint—and the volatile alkali—and likewiſe emetics—are ready for immediate uſe.

ON account of the commodious ſize of the caſe, and the variety of inſtruments it contains, a little management is requiſite in order to adapt them to anſwer their different purpoſes: this may at firſt appear a trifling objection; but a little attention to the following directions, and the annexed plates, will immediately remove it.

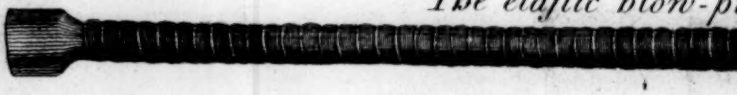
WHEN air from the lungs of a healthy perſon is to be uſed, that end of the ivory or ſilver mouth-piece which is marked (1) is to be ſcrewed to the large flexible tube where it is marked (2); the pipe for the noſtril (3) being at the other end, the inſtrument is complete. See Plate III. Fig. 1.

When atmoſpheric air is to be uſed, the conical part of the hollow ſteel ſcrew (marked in the plate 4) is, by means of the braſs winch (6), to be firmly ſcrewed

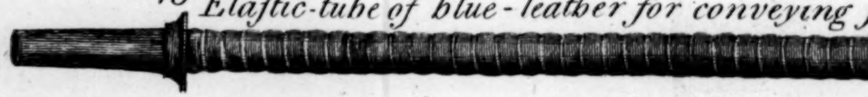
Pipe for the Noſtril



The elaſtic blow-p

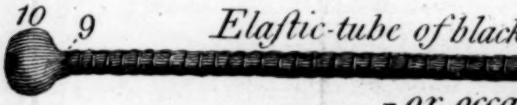


Elaſtic-tube of blue-leather for conveying

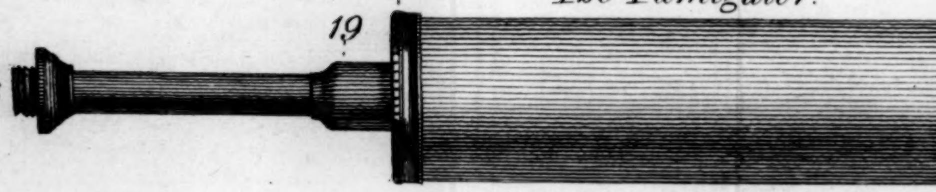


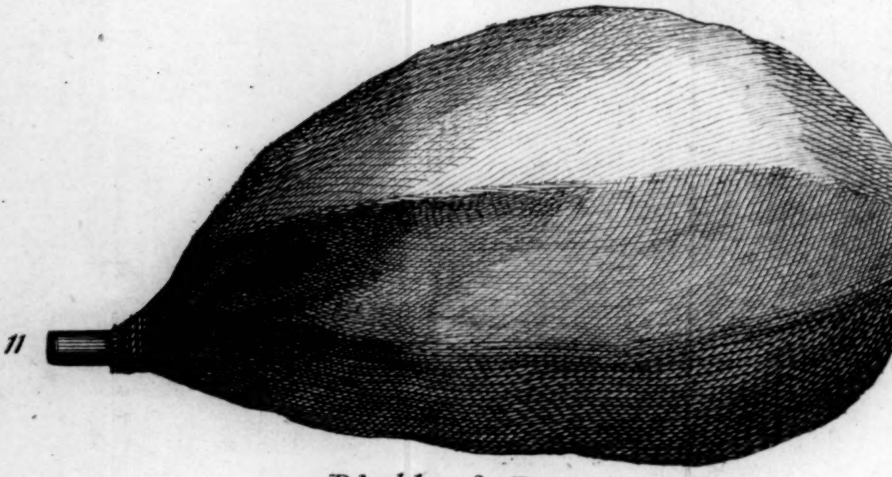
Elaſtic-tube of black

- or occa



The Fumigator.



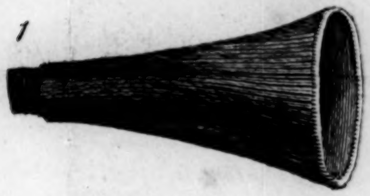


Bladder & Pipe.

I. Savigny Inv.^{t}

Plate II.

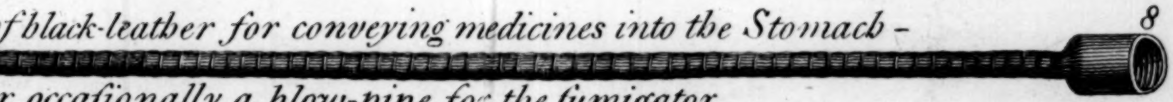
The mouth piece of the elaſtic - blow-pipe & occaſionally the funnel to convey medicines into the stomach



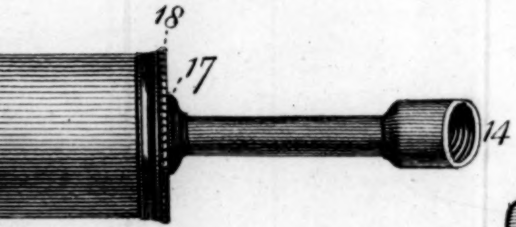
ow-pipe for the lungs.

ying fumes into the Inteſtines.

f black-leather for conveying medicines into the Stomach -

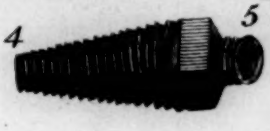


r occaſionally a blow-pipe for the fumigator.

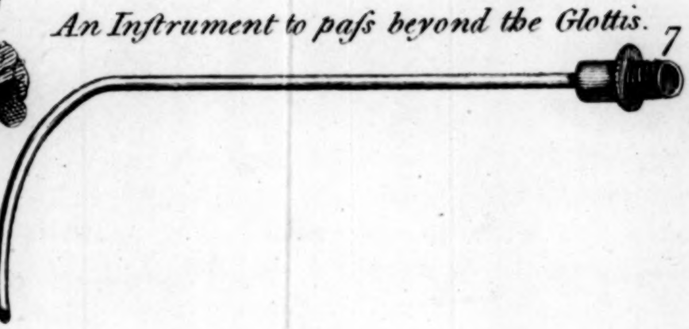


Winch for the screw.

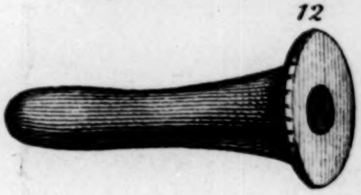
The hollow connecting screw.



An Inſtrument to paſs beyond the Glottis.



Pipe for the rectum



Strongitharm ſc.

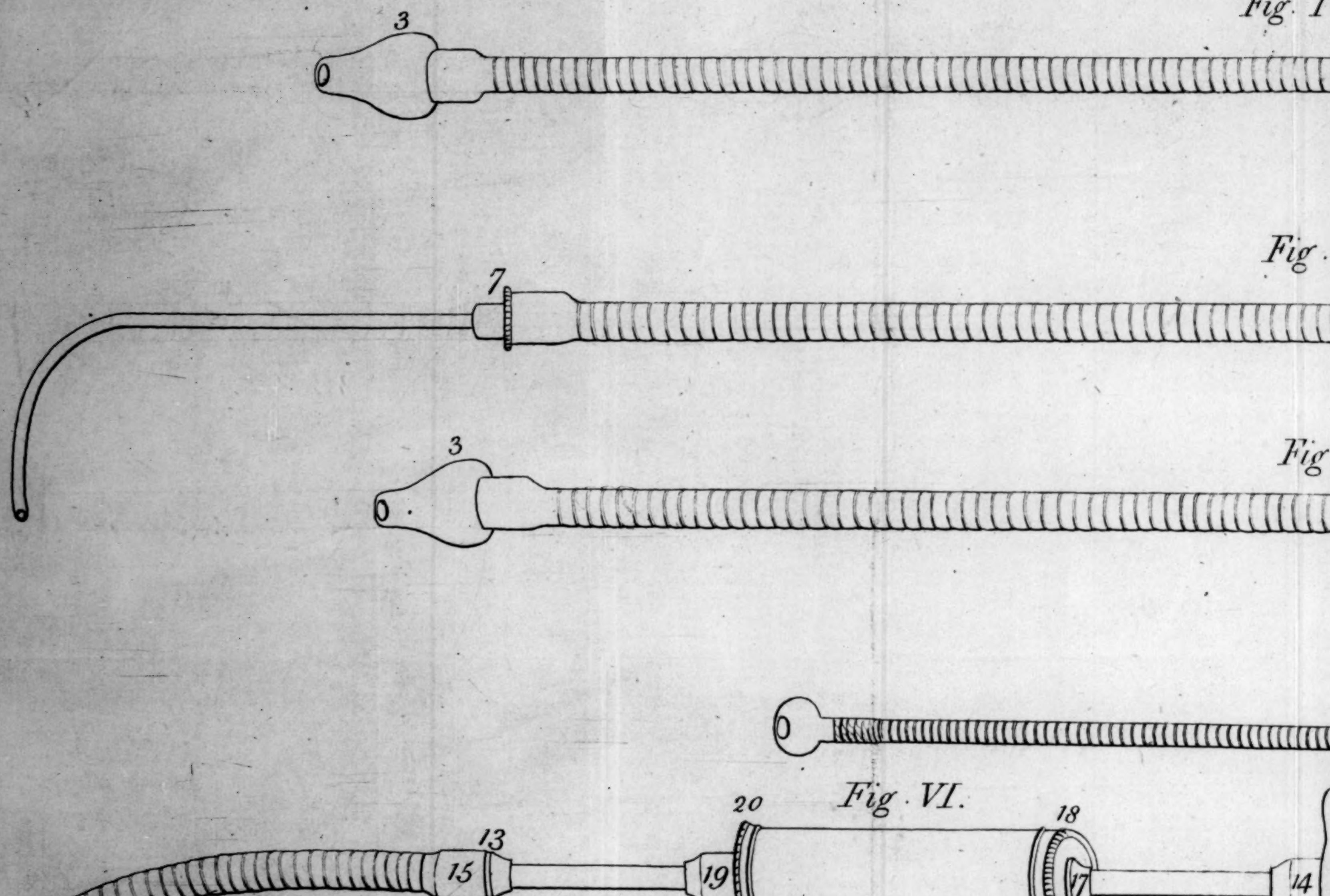


Fig. I

Fig .

Fig

Fig . VI.

I. Savigny Invt

Plate III.

ig. I.

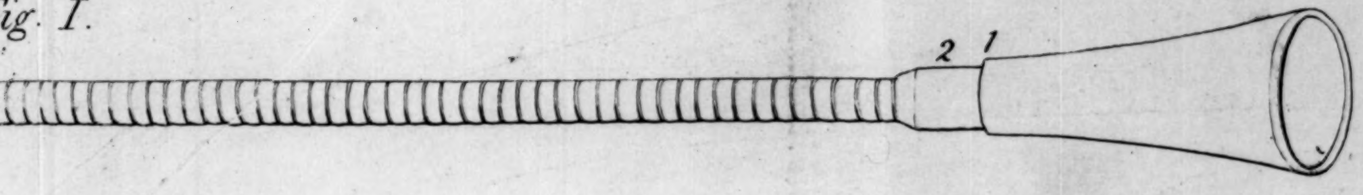


Fig. III.

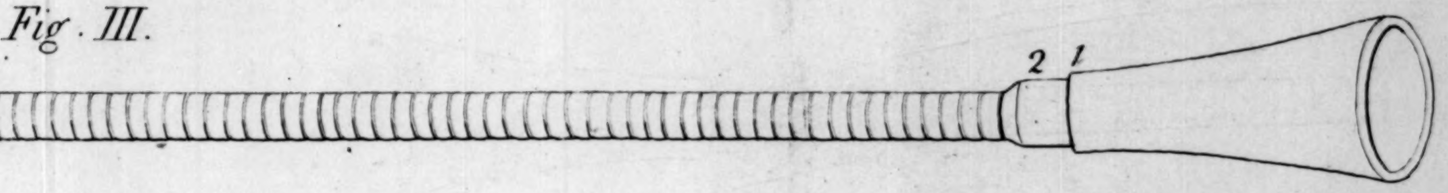


Fig. II.

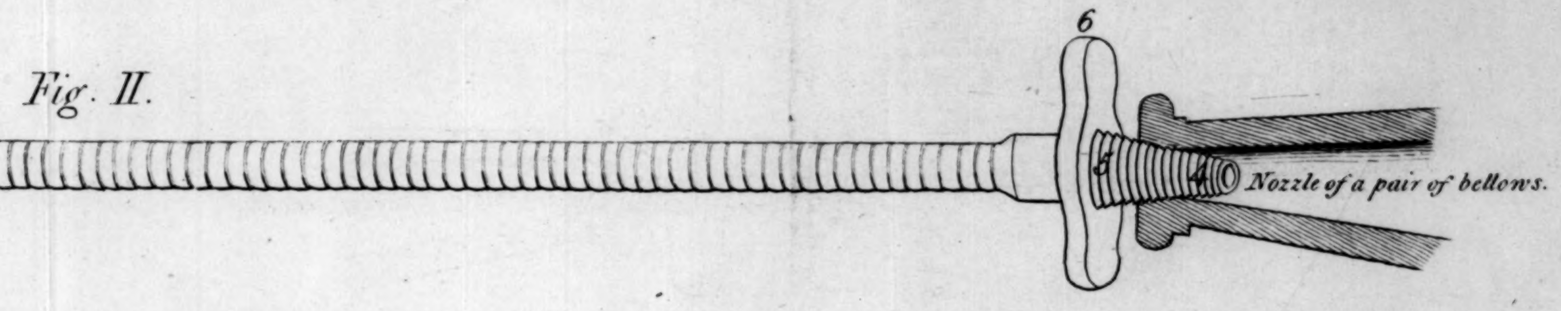
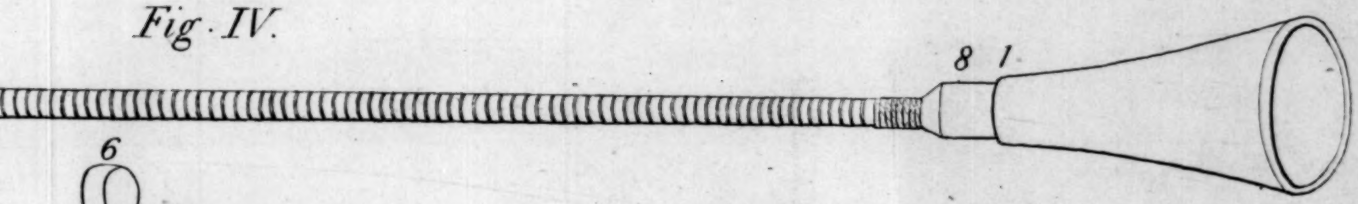


Fig. IV.



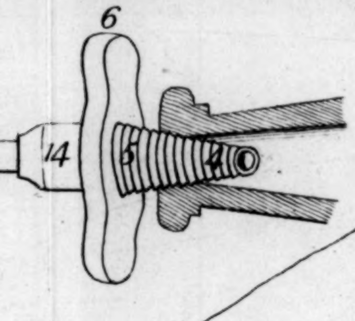
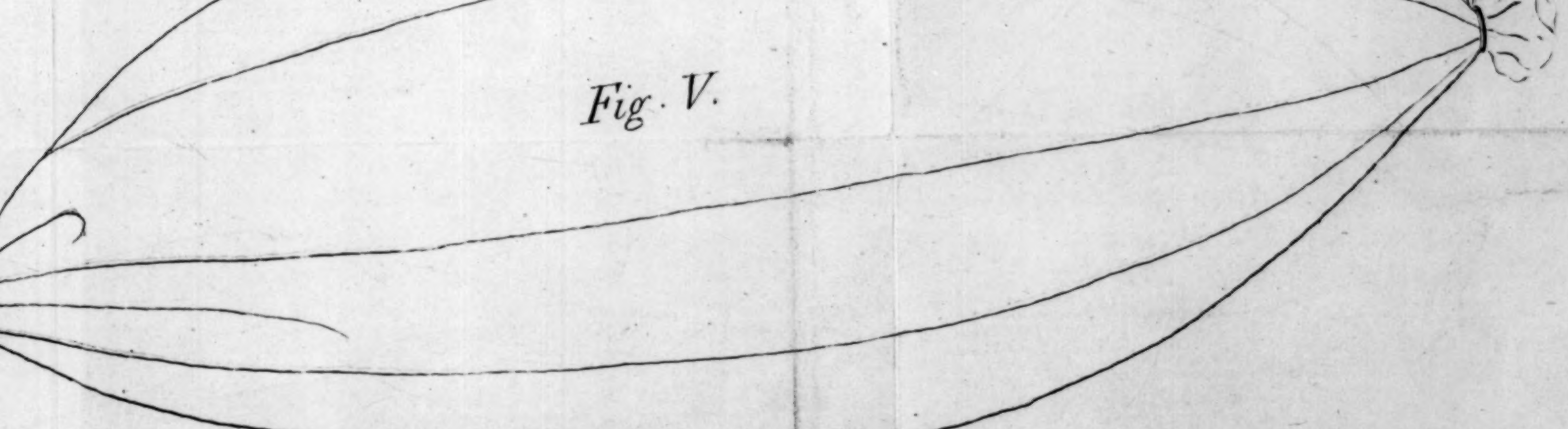


Fig. V.



Strongitharm sc.

ſcrewed into the nozzle of any common pair of bellows: — the ivory or ſilver mouth-piece (1) of the large red flexible tube, is then to be removed, and the other end of the conical ſcrew (marked in the plate 5) is to be fitted in its place. See Plate III. Fig. 2.

Should any particular impediment to the inflation of the lungs, render it neceſſary to have recourſe to an inſtrument to paſs beyond the glottis—or ſhould it become neceſſary to perform the operation of trachæaotomy — the pipe for the noſtril (3) is to be removed, and the inſtrument ſhaped like a male catheter (7) is to be ſcrewed in its place. See Plate III. Fig. 3.

For injecting fluids into the ſtomach, the ivory or ſilver mouth-piece of the inflating inſtrument (1) is to be ſcrewed on the ſmall black leather tube, where it is marked (8) — the mouth-piece is to ſerve as a funnel. See Plate III. Fig 4.

For the injection of watery clyſters, the ſmall tube (11), connected to the bladder concealed in the head of the caſe, is to be introduced into the opening of the large clyſter-pipe (12), which is then ready for immediate uſe. See Plate III. Fig. 5.

When the ſmoke clyſter is preferred, the conical part of the hollow ſteel ſcrew (4 in the plate), is, by means of the winch (6), to be firmly ſcrewed into the nozzle of any common pair of bellows, in the ſame manner as when atmoſpheric air is to be thrown into the lungs. — The cylindrical part of the ſcrew (marked 5 in the plate), is then to be connected with that end of the fumigator neareſt the lid, marked (14) :—to the other end of the fumigator (13) the blue leather tube is to be affixed by means of the ſcrew (15), and the other part of the tube (16) is to be introduced into the pipe for the rectum (12), when the inſtrument will be perfect. See Plate III. Fig. 6.

If the conical ſcrew ſhould be employed in inflating the lungs — or if for any reaſon it is not convenient to uſe the bellows— the fumigator can then be worked with the mouth. When this may be the caſe, the only alteration required will be, that the ivory or ſilver mouth-piece of the inflating tube (1) ſhould be united to the black leather tube at (8), or the fumigator at (14), in lieu of the cylindrical ſcrew*.

To render the caſe more compact, the fumigator is taken to pieces; but is readily put together again, by connecting the numbers (17 with 18) and (19 with 20).

* The moſt effectual and expeditious method, by far, of lighting the herbs in the fumigator, is by directing the flame of a candle on them, by means of a blowpipe: the crooked ſilver tube (7) will anſwer that purpoſe. Phoſphorus and matches are provided, in caſe a light cannot otherwiſe readily be procured.

I T is ſurely unneceſſary to remark, that every one who preſumes to take upon himſelf the important office of directing the remedies that are to be uſed for the recovery of the apparently dead, ſhould be provided with every inſtrument that can be neceſſary to ſecond his intentions: this part of our profeſſion is, under the moſt favourable circumſtances, ſufficiently beſet with difficulties; and it is eaſy to conceive what muſt be the event in thoſe caſes, where any of the more eſſential remedies are omitted.

I cannot in juſtice conclude without mentioning, that Mr. Savigny, the very ingenious and celebrated inſtrument-maker, has ſpared neither time, attention, or expence, in rendering this caſe as complete as its nature will permit.

F I N I S.

BRITISH 21 JY 81 MUSEUM

DIRECTIONS TO THE BINDER,

for placing the PLATES, &c.

Plate I. - - *to face page* 192

II.
III. } - - - - 270

Half Sheet of Letter Preſs, marked N° 1. - - *to face page* 193

Whole Sheet D°, marked N° 2. - 196

Plan of a general Table (a large whole Sheet Copper Plate, without a Number) *to follow the preceding Whole Sheet.*

Half Sheet of Letter Preſs, marked N° 3. - - *to face page* 197